MODERN PLASTICS

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JANUARY 1947

CAST PLASTIC DIES · PATTERNS · JIGS

Typical of the current trend toward making production methods ultra-efficient is the use of Durez casting resin . . . to reduce the time and cost involved in conventional die-, pattern-, and jig-making . . . to speed production.

Cast Plastic Dies

Durez casting resin lends itself readily to cast forms for hydropress operation. The cast plastic die illustrated above left is used regularly under 75 tons press load and has produced hundreds of pieces, similar to the one shown below it, without flaw. Tests have shown it to be capable of withstanding up to 270 tons press load, equivalent to about 12,000 psi.

Cast Plastic Patterns

Alert foundrymen everywhere have been quick to see the production advantages of cast Durez resin patterns such as the match plate illustrated above center. The inexpensive Durez casting resin is simply poured and cured. The perfectly reproduced pattern is then mounted on the plate. The time- and cost-saving benefits are obvious.

Cast Plastic Jigs

The fixture, illustrated above right, for holding die-cast metal covers while a few finishing operations are performed is an excellent example of the simplicity of producing such fixtures with Durez casting resin. It was only necessary to coat the inside of one of the covers with a parting agent and pour in the resin. While the resin was in a semi-viscous state, the stud was located in place. After allowing the assembly to set for a few hours, it was placed in an oven and cured. When taken from the oven, the die-cast cover was removed and the fixture ready for use, the stud being anchored securely in the resin. Long-wearing qualities of the casting resin are excellent.

Characteristics of Casting Resin

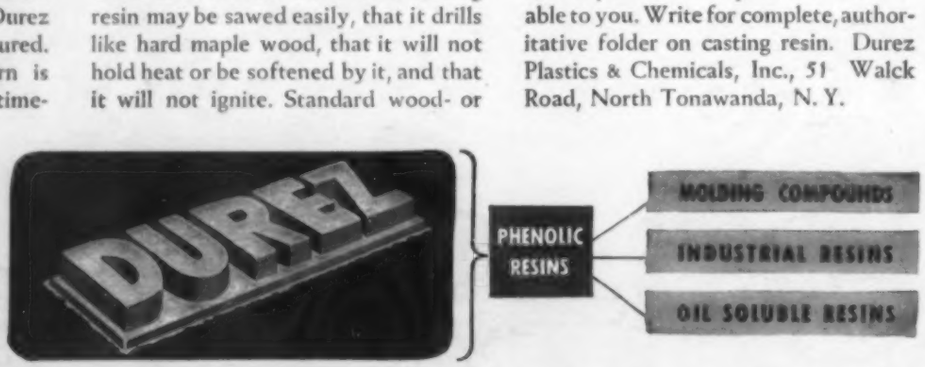
Tests have shown that Durez casting resin may be sawed easily, that it drills like hard maple wood, that it will not hold heat or be softened by it, and that it will not ignite. Standard wood- or metal-working equipment may be used. The liquid resin follows the contours of any part exactly and holds them to predetermined tolerances. Its shrinkage factor is but .0025 inches per inch.

Other Uses

A few additional uses for Durez casting resin are stretch-press dies, masking shields for plating, models for testing and duplicating, and checking and assembly fixtures.

Informative Booklet

As specialists in the production of phenolic plastics and resins for almost three decades, Durez technicians have gained an enviable record for developing plastics and resins that fit the job. This background includes molding compounds, industrial and protective coating resins. The benefits which this rich experience can provide are available to you. Write for complete, authoritative folder on casting resin. Durez Plastics & Chemicals, Inc., 51 Walck Road, North Tonawanda, N. Y.



PLASTICS THAT FIT THE JOB

"WHEN *Catalin* COOKS WITH COLOR, THE OVEN'S MELLOW"

The hepcats are buzzin' about the new Rock-Ola Automatic Phonograph. "A mellow oven" is the way they describe it. "Oven" is jive talk for phonograph (that's where you put the *hot platters* — jive records). And they say it's mellow because its brilliant, lustrous color — the gemlike color of Catalin — "sends" them. A boy and a girl, sweet music and sparkling color . . . no room for gloom here. In the Casbah Code Catalin is L. O. P. — the Life of the Party!

That cascade of scintillating color which immediately catches the eye . . . the graceful, fluted pilasters and corner caps and the top center panel bearing the Rock-Ola name-plate, are all of Catalin. Only Catalin could provide strong, thick-walled sections which would faithfully transmit the rainbow hues of the revolving interior lighting. Rippling rhythm and bright, magnetic color create a lively party atmosphere whenever Rock-Ola and Catalin make beautiful, colorful music together.

Gay and flamboyant or dignified and luxurious . . . Catalin's lustre, finish and inherent depth of color make it so versatile that it readily adapts itself to whatever the required role. Catalin castings produced in straight-draw, split or core molds offer complete design freedom at comparatively low tooling costs.

Product designers aware of a customer preference for color interpreted in its richest and most appealing sense turn naturally to Catalin. Our service staff will be glad to help you in planning *your* setting for *the gem of plastics.* Inquiries invited.

CATALIN CORPORATION OF AMERICA
ONE PARK AVENUE • NEW YORK 16, N. Y.

CAST RESINS • LIQUID RESINS • MOLDING COMPOUNDS

MODERN PLASTICS

VOLUME 24 JANUARY 1947 NUMBER 5

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They look good enough to eat in

Colorful upholstery is another interesting application for GEON polyvinyl raw materials

THOSE handsome dining room chairs are upholstered with a flexible plastic sheet made from one of the GEON polyvinyl resins. Lovely to look at, the upholstery offers many extremely practical advantages, too. Resistance to wear, for example, is just one of a long list that includes resistance to foods, dirt, oils, greases, water, heat, cold, fading, aging, and most other normally destructive factors. The material is easily cleaned with soap and water.

These properties, plus many others, have made versatile GEON the ideal material for literally hundreds of products in the home and in industry —shower curtains and fly swatters— draperies and floor tiles — clothing and luggage — wire insulation and acid tank linings.

And GEON can be pressure or injection molded, extruded, calendered or cast into sheet or film. In solution or latex forms it can be applied as coatings for fabrics and fibres of all kinds as well as for paper and cardboard. Products made from GEON may be flexible or rigid, clear or opaque, brilliantly or delicately colored.

Other raw materials made by B. F. Goodrich Chemical Company include HYCAR American rubber, KRISTON thermosetting resins, and GOOD-RITE brand chemicals. While we make no finished products, we'll be glad to help with special problems or applications. For more information, please write Dept. O-1, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B. F. Goodrich Chemical Company

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GEON polyvinyl materials • HYCAR American rubber • KRISTON thermosetting resins • GOOD-RITE brand chemicals

...KNOWN BY THE COMPANY WE KEEP

With its unique safety side-rests, the "Tru-Heat" iron is easily rolled on either side instead of tilted back on the heel. With this lower center of gravity, tipping accidents are avoided.

THE NEW GENERAL MILLS "TRU-HEAT" ELECTRIC IRON WITH PLASTICS HANDLE *MOLDED BY CMPC*

You can't imagine General Mills dealing with any but top-notch sources of supply. That's why it was only natural that they selected CMPC to mold plastic handles for their new "Tru-Heat" Electric Iron.

Shaped for comfort, the new "Tru-Fit" handle provides an easy, restful grip and the extra space between iron and handle means less heat on the hand . . . features which make for easier selling, and, of course, enthusiastic users.

Particularly interesting is the method of molding this handle. Though cored for insertion of cord and "Tru-Heat" fabric selector dial, no removable split cavities were necessary. Cores were withdrawn hydraulically. Result . . . fast, accurate, economical production.

CMPC has a knack of providing the right answer to 'most any kind of plastic molding problem. Perhaps that's why the biggest names in industry come to CMPC . . . why parts molded by us are usually found on the "best seller" list. In any case, it's a mighty good reason for discussing your problems with a CMPC Service Engineer. There's no obligation.

CHICAGO MOLDED PRODUCTS CORPORATION

Plastic Molders

1046 North Kolmar Avenue, Chicago 51, Illinois • Representatives in principal industrial centers

COMPRESSION AND INJECTION MOLDING OF ALL PLASTIC MATERIALS

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There's a selling job ahead

Since it is the custom for editors to make predictions at the beginning of every year we will make ours right now. We predict that in order to be successful in 1947, every person in the plastics industry will have to roll up his sleeves a bit higher and pitch in a mite stronger than he ever has before. If he thinks 1946 was tough, he will find 1947 tougher.

We trust that our readers will not consider us pessimistic because we truly expect this industry to take great forward strides in 1947 but those steps will be taken only as the result of superhuman effort.

To back up our prediction, we first call attention to Mr. W. Stuart Landes' statement on page 110 of this issue where he calls particular attention to the raw materials shortage, the dangers of over-expansion in some categories and particularly the price situation which he intimates may be of much more concern to molders than any raw material shortage in 1947.

Secondly this magazine's survey indicates that many processors are so intent on obtaining material that they are inclined to overlook the problems of tomorrow which are pyramiding in rather fearsome fashion. The trouble is that as long as we are rolling along at a rapid clip, we hesitate to lift the hood to ascertain the cause of an occasional miss. As long as we are on the way, why not step on the accelerator and take a chance the old jalopy will get there before it breaks down.

Those misses or problems will become increasingly troublesome until action is taken to correct them. True enough there will be a raw material shortage in most plastics throughout a great part of 1947 unless demand falls off. The thermoplastic situation may be relieved by the expected increase in polystyrene, but basic shortages in benzol, formaldehyde and urea crystal may prevent any similar large increase in thermosetting materials. The shortage of plasticizer causes one to ponder how a situation could arise in which thousands of pounds of resin or cellulosics are manufactured when there seems no possible way to procure the needed plasticizer.

Competition from other materials is certain to be more difficult with increasing quantities of rubber, metal, wood, ceramics and, probably, leather coming to market. There is also the terrific danger that plastics will be degraded as a result of the use of inferior plasticizers because the proper ones are unobtainable, and as a result of faulty workmanship by operators who are concerned only with today's market and have no concern over plastics' reputation for the future. When this combination of plentiful competition and poor workmanship get together, plastics marketing will get tough.

One answer is education. Suppliers still have a job to do in educating their customers on correct applications for their materials. And the entire industry has a job to do in educating the public. It can't be done with an occasional booklet or radio program. It should be a constant, never-ending campaign with every member of the industry taking an active part.

The password of the industry for 1947 may well change overnight from "buy" to "sell."

Number, Please... Big Numbers!

When America switched to the monophone telephone in 1925, millions were needed—quick. The job called for complex molds—presses to handle heavy pieces—ample production. Kurz-Kasch did it first!

Many firms and individuals have contributed to the amazing advances of the plastics industry. As this series of ads testifies, Kurz-Kasch and its engineers have played their parts since the very earliest days.

We mention it only because yesterday's achievements are your promise of added competence today—because by choosing Kurz-Kasch as your molder now, your production will benefit *ahead of time* from many of the improvements of tomorrow. And that pays off.

Investigate our complete molding service. Write for your free copy of "A Businessman's Guide to the Molding of Plastics"—or ask for an engineer.

Kurz-Kasch

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Planners and Molders in Plastics

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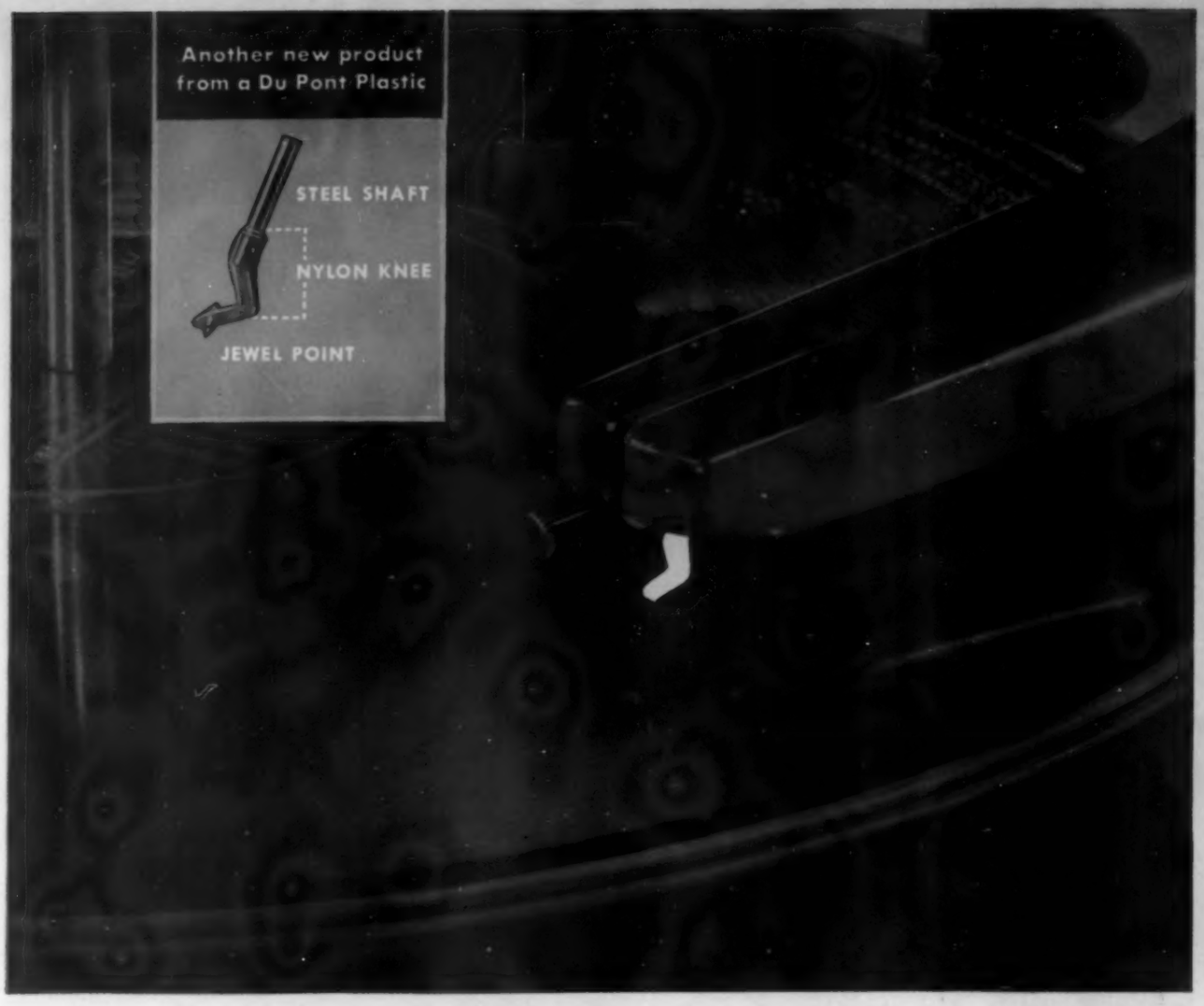

NEEDLE WITH A NYLON KNEE

Better tone . . . new profits . . . based on Du Pont NYLON

New cartridge pickup has Du Pont nylon chuck

Made to improve reproduction, needle life and record life, this new pickup cartridge for phonograph arms contains a tapered nylon chuck to grip nylon needles. Made by the Astatic Corporation. Molded nylon parts supplied by Nosco Plastics.

"A real achievement," said a leading manufacturer of fine phonographs about the tone pickup of this sales-stirring new nylon needle.

Because of its flexible knee-like bend, this needle minimizes record wear and needle scratch too. It shock-absorbs unwanted record vibrations, and it's so tough it's almost break-proof in ordinary use. It grasps the jewel tip in a vise-like grip . . . obviates the need for rigid mountings. Production-wise, nylon molds uniformly . . . keeps output up and costs down. All told, it provides a new slant on an old product to help keep sales on the up-curve.

Look to nylon . . . and other Du Pont plastics . . . for new-product possibilities and for adding sales appeal to the old.

Write now for literature. It will pay you to have it in your files. E. I. du Pont de Nemours & Co. (Inc.), Plastics Department, Room 361, Arlington, N. J.

Nylon needle designed and manufactured by Hutter Development Co. Distributed by Decca Records, Inc., and Chicago Webster Corp.

DU PONT
REG. U. S. PAT. OFF.
Plastics
BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

for DIFFICULT MOLDING . .

The child's training seat (illustrated) well exemplifies the molding capacity and versatility of the Reed-Prentice 22 Oz. Plastic Injection machine. This product is molded in both Butyrate and Styrene by the Plastics Manufacturing Company of Dallas, Texas. The shot shown is manufactured from Butyrate and weighs 21.55 ounces — the cycle is from 53 to 60 per hour, depending upon the material used.

In order to produce perfect shots of this type and still maintain a fast cycle, complete machine coordination is required. In all Reed-Prentice plastic injection molding machines can be found the accurate timing, high plasticizing capacity, constant pressure on the plunger and material — that results in fast, uniform feed to the mold cavity. Temperature control when used with capacity shots must be held to a fixed, exact limit, without variations. This feature is outstanding in Reed-Prentice machines.

The combination of these and many other features results in moldings perfectly filled — with no sinks, flash or scratches.

Whether your problem calls for a mold with multiple small cavities or with a single large cavity, Reed-Prentice injection molding machines will give you finished products to your most rigid specifications. These machines are available in 22, 16, 12, 8, 6 and 4 Oz. capacities. Write for complete information to Dept. D.

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1213 W. 3rd St., Cleveland 13, Ohio

Celanese*

PLASTICS GET THE PRODUCT ON THE MARKET FASTER

For the shortest distance between design and finished product look into Celanese fast-molding thermoplastics. These tough, colorful synthetics mold to accurate dimension—with high-lustre mold finish that cuts buffing time to a minimum. Metal inserts and molded-in threads reduce assembly operations.

THE CELANESE FAMILY OF THERMOPLASTICS INCLUDE

- the *toughest* thermoplastic commercially produced
- the *widest* color selection
- the *clearest* crystal-clear cellulosic plastic
- the *most flame-resistant* cellulosic plastic
- the *most brilliant* mold finish of any thermoplastic
- the *fastest-molding* thermoplastic
- the *greatest number* of molding formulations

Before planning a product, get together with the Celanese Technical Service Staff. It is equipped to offer sound and impartial advice—to furnish latest field test information—to point out where product designs can benefit by exact knowledge of how a plastic material will stand up in service. Celanese Plastics Corporation, a division of Celanese Corporation of America, 180 Madison Ave., N. Y. 16, N. Y.

FORTICEL* CELLULOID* LUMARITH* VIMLITE* CELCON†

AVAILABLE TO EXECUTIVES AND MANUFACTURERS: 87-page illustrated book on the subject of molding with Celanese Plastics. Please request on your company letterhead.

*Reg. U.S. Pat. Off.
†Trademark

Why hard rubber for fountain pen parts?

The solution to a design or production problem of your own may be found in this list of reasons why so many fountain pen manufacturers use hard rubber:

1. An exacting capillary action in the feed rod to insure an ever-ready smooth flow of ink.
2. Immunity to the corrosive action of ink.
3. Stability when in contact with oil, water, heat, cold, or changing temperatures.
4. Good machining qualities.
5. Resistance against chipping, splitting and cracking under normal usage or when dropped.
6. Stability under pressure (for pens fly today with air passengers).
7. Price—hard rubber is cheaper than other plastics currently being considered for this application.
8. Ample supply.

In addition, hard rubber finishes to a soft, lustrous ebony with a smooth contour. No mitre lines appear on the pen. It has a pleasant, sure feel in the hand of the user. It is a hard compound with a certain degree of resiliency which makes it a fine material for cutting, facing, grinding, reaming, or tapping.

We manufacture rods and tubing in rough, ground, or polished form to the tolerances specified by fountain pen manufacturers. Our chemical and engineering staff has developed specific rubber compounds for these applications. However, since we have research and manufacturing facilities for both rubber and plastics, our laboratories test new developments in both so we can suggest better materials as they appear.

Do you need a lot of something like fountain pen parts?

If you are planning or using large quantities of a product that approximates these parts in size, shape, physical and chemical requirements . . . or something which may gain added appeal from that certain satisfying "heft" and "feel" of hard rubber . . . chances are that our experience and facilities for efficient large volume production will enable us to fill your needs at reasonable cost.

VULCANIZED RUBBER AND PLASTICS COMPANY

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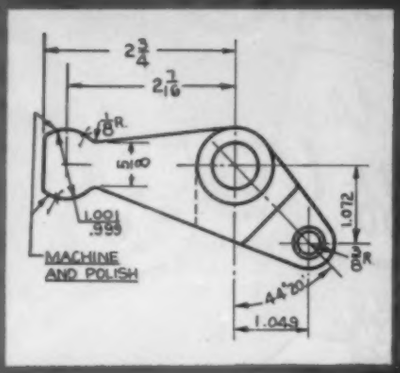
Manufacturers of Rubber and Molders of Plastics

General Offices: 4 East 29th Street, New York 16, New York Works: Morrisville, Pa.

Can you Save 1½ Minutes on Each Shift Lever?



The case history of this shift lever job emphasizes the time-saving obtained with the Milwaukee 2D Rotary Head Milling Machine. The part used as an example here, was previously milled with a special form cutter: floor to floor time, 3¼ minutes. Read this job report:

Shift Lever Material — Malleable Iron Casting.

Operation — Mill 1" diameter

Number of Pieces — lots of 300

Initial Setup Time — 20 minutes

Rough and Finish Mill — Stock removed ⅛" on the diameter

Floor to Floor Time — 1¾ minutes

Check these advantages of the Milwaukee Rotary Head Milling Machine and how you can benefit from them in your own shop:

DIRECT . . . mills intricate shapes in a single setup without the aid of templets or models — transmitting blueprint dimensions and outlines directly to the workpiece.

ACCURATE . . . chances for error are eliminated because there is no change in setup. Exact control of all combinations of cutting movements — possible only with this machine — transmits mathematical precision to the work.

FAST . . . initial job preparation and setup time are reduced to the minimum. Accurate performance of the machine saves operator's time and results in rapid production of work otherwise difficult to perform.

Write for Bulletin No. 1002C and complete information.

Kearney & Trecker

CORPORATION

Milwaukee 14, Wisconsin

4729

GE CYCLE TIME ON THE ABOVE POLYSTYRENE PARTS IS LESS THAN ONE MINUTE • PARTS COURTESY COLUMBUS PLASTICS PRODUCTS

THE H-P-M 16 OZ. FOR PRODUCTION MOLDING OF LARGE AREA PARTS !

The Model 350-H-16 injection molding machine, equipped with multiple cavity molds, provides greater production per machine without increasing labor costs. Also, large parts up to 16 ounces each can be economically produced.

This large capacity machine provides the same high production, profit making features as smaller H-P-M units . . . positive straight-line hydraulic mold clamp, accurate gravity type material feed, fast plasticization with two-zone electric heat, high speed operation. In addition to these exclusive operating features, this H-P-M 16-ounce machine is designed for easy access to all components requiring maintenance or service. All hydraulic units, including pumps, valves and controls, are designed and built by H-P-M for heavy duty service.

THE HYDRAULIC PRESS MFG. CO.

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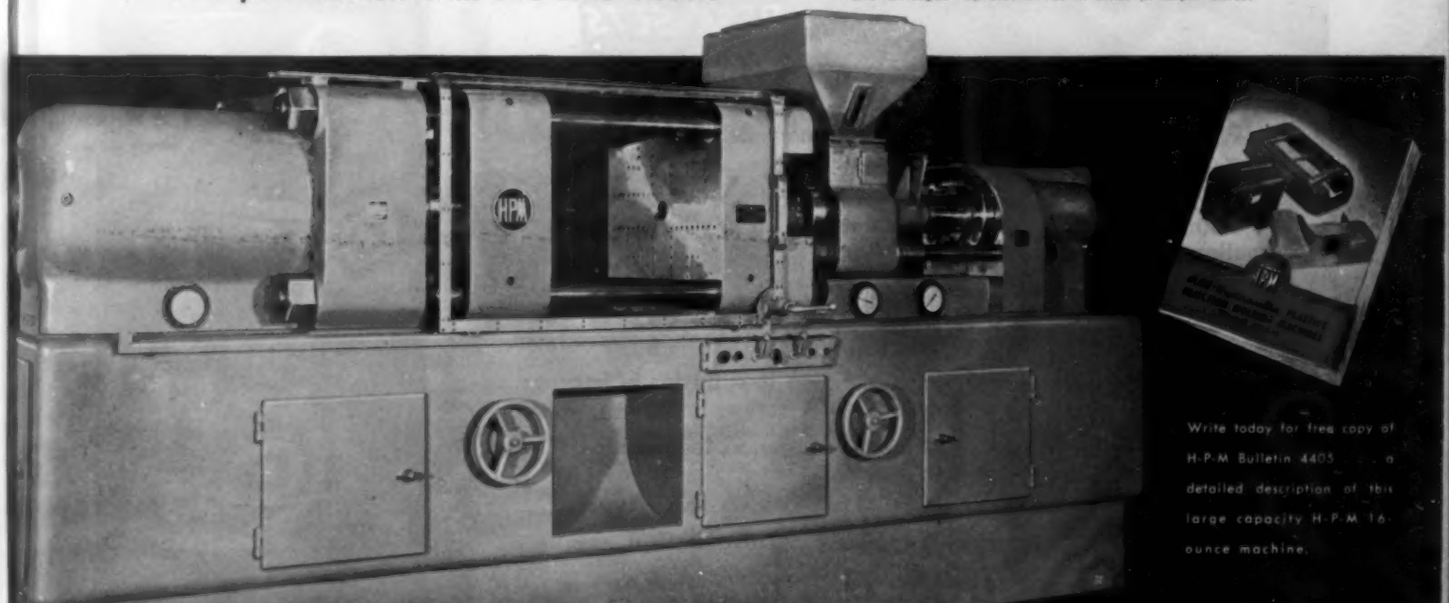
Branch offices in New York, Philadelphia, Cleveland, Cincinnati, Detroit and Chicago. Representatives in other principal cities.



Write today for free copy of H-P-M Bulletin 4405 . . . a detailed description of this large capacity H-P-M 16-ounce machine.

HPM

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

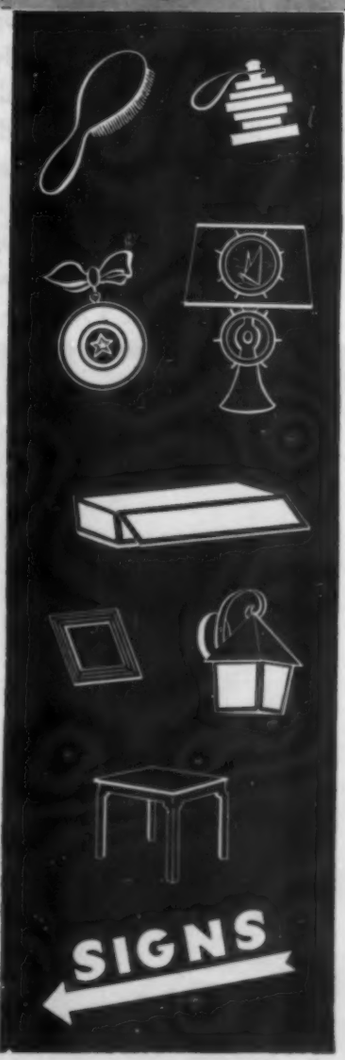
Self-Contained • All-Hydraulic

INJECTION MOLDING

FOR MOLDING THERMO-PLASTICS

The All-Purpose Plastic of Surpassing Beauty . . .

Mottletone



New ideas—new color combinations—new fields to explore—that's the challenge to all the users of Mottletone.

This new acrylic—now available for general use—is the ideal plastic for almost everything from radios to umbrella handles, from clocks to buttons.

Mottletone is *mottled through and through* and retains a lustrous polish on its marblized surface. Its durable and versatile qualities lend themselves to many shapes and to a great variety of products.

Mottletone is the material you have been looking for to improve an old product or to sell a new one.

For further information and technical assistance, feel free to call upon us. Our laboratory is at your service.

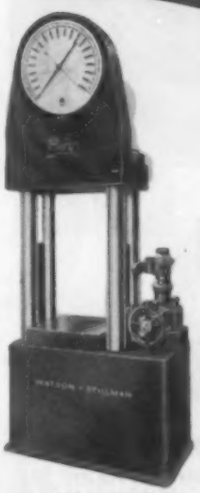
For Further Information, etc.

Plasti-chrome, inc.

85 FIFTH AVE. PATERSON 4, N. J.

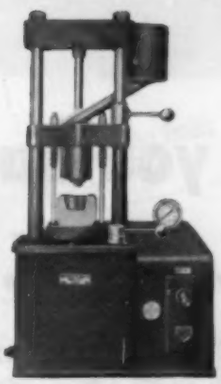
DON'T TIE-UP YOUR LARGE EQUIPMENT

Laboratory Presses
10 to 50 tons



Laboratory Presses
100 to 200 tons

Power Operated Presses
20 to 200 tons



One-oz. Laboratory
Injection Molding Machine

THIS standard line of machines designed for laboratory *testing* has proved invaluable, too, in aiding *production* – by supplementing large production units in handling many short-run jobs within their capacity. They are being used for plastic compression molding, laminating, die sinking, briquetting, liquid extraction, and in many other applications.

An extensive line of optional equipment is available to further increase the utility of these machines: steam or electric hot plates, and self aligning swivel top platen are some of the features that may be added to the standard presses.

The One Ounce Injection Molding machine is designed primarily for experimental and short run injection molding. It is sold as a complete unit and does not require any additional equipment.

These presses, in capacities from 20 to 200 tons, are fully described in bulletins Nos. 350-A, 370-C and 623-A. Write Watson-Stillman Co., Roselle, New Jersey.

#130

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HYDRAULIC MACHINERY DIVISION

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ROSELLE, NEW JERSEY

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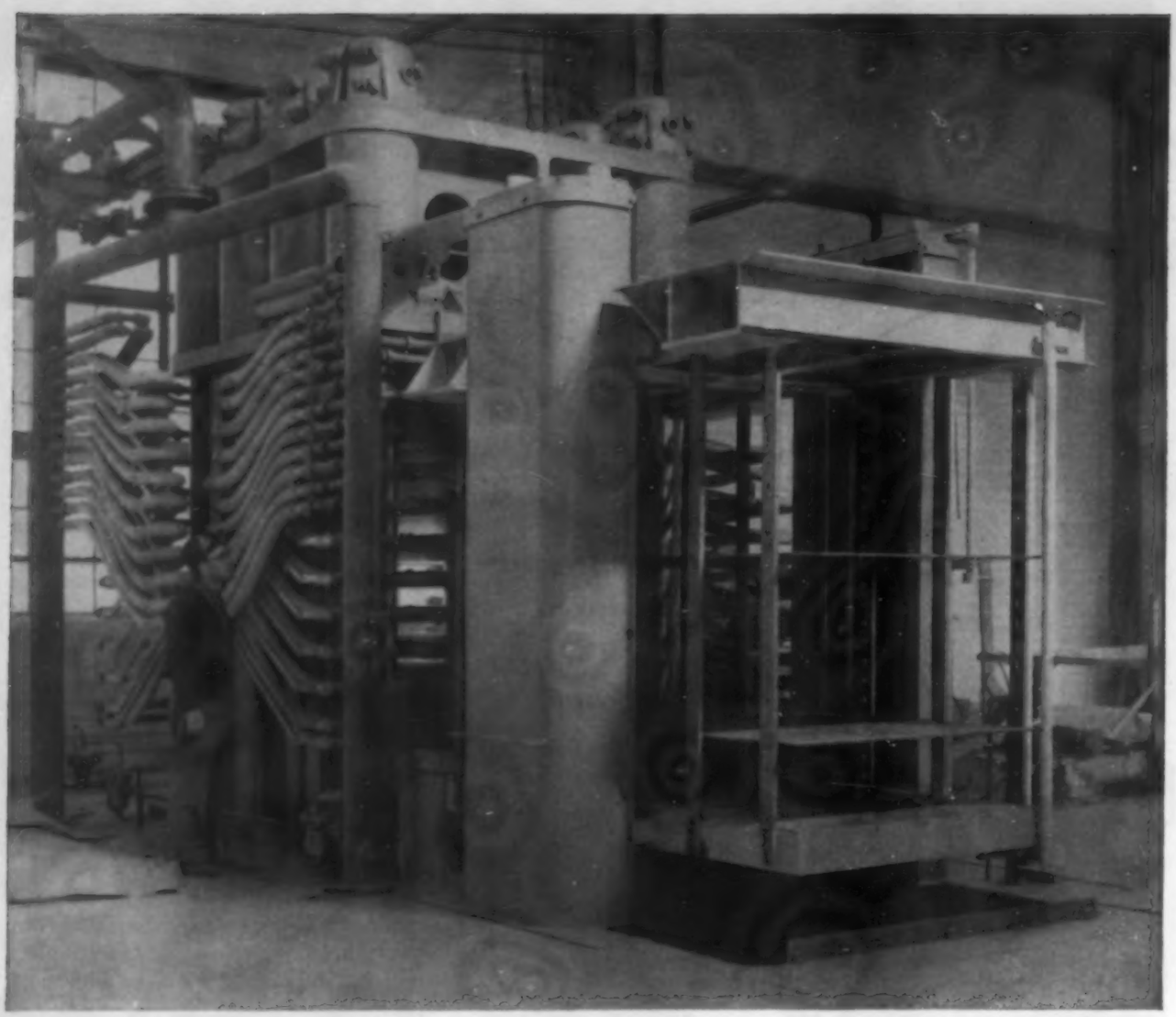

Tell us the press you have in mind

. . . WE'LL BUILD IT

Every Bethlehem hydraulic press is a built-to-order job, with every detail supervised by top-flight engineers. The unit we deliver to you is precision-made and will expertly do the work you visualized in the planning stage.

Bethlehem is equipped to supply both large and small presses in hot-plate and other types. They can be furnished with or without self-contained or separate hydraulic power systems.

When figuring an installation for plastics, wallboard, fiber board, vulcanizing, or metal-forming, let Bethlehem work with you. Our long experience in this field makes us particularly well qualified to help.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM

Custom-Built

HYDRAULIC · PRESSES

★ BETHLEHEM STEEL ★

*RICHARDSON MEANS *Versatility* IN PLASTICS

QUIET PLEASE

. . . a brain-child is having its breakfast

He's feeding fluid to a new idea . . . fattening a project that has possibilities. It's research . . . the way Richardson does it.

And how does Richardson do it? We don't take "no" for an answer. We won't accept "yes" either. Not until *Richardson Plasticians* have stripped every theory to the bone, made each new product stand up and prove itself. That's the way Richardson developed EBROK bituminous battery containers; over 700 special grades of Laminated INSUROK; special molding techniques; and our own tooling facilities. All these enable us to meet widespread industrial requirements. This is *versatility.* And it's one of the reasons why our customer list is growing greater every year!

INSUROK *Precision Plastics*

***DESIGNING**
. . . Artistic visualization. Creative engineering. Practical planning for efficient plastics production.

***PRODUCTION**
. . . Complete machine shop facilities for manufacturing our own dies, molds, tools.

***LAMINATING**
. . . Sheets, rods, tubes. Standard NEMA grades; over 700 special grades.

***MOLDING**
. . . Rubber and bituminous plastics; and synthetic resin plastics . . . Beetle, Bakelite, Durez, etc.

***FABRICATING**
. . . Complete equipment for drilling, punching, sawing, turning, milling, etc.

The RICHARDSON COMPANY

Sales Headquarters: MELROSE PARK, ILL. FOUNDED 1858 LOCKLAND, CINCINNATI 15, OHIO

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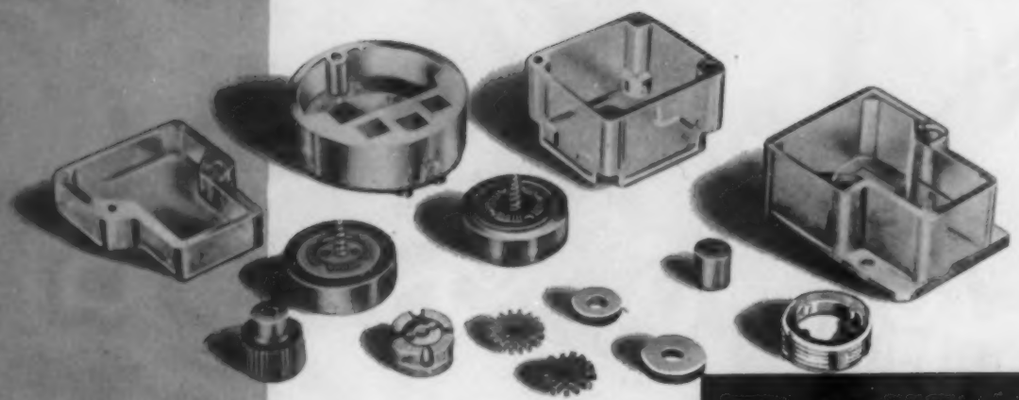
HERE DWELLS
INGENUITY

Atlantic

OF NEW YORK



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PRECISION INJECTION MOLDED PLASTICS

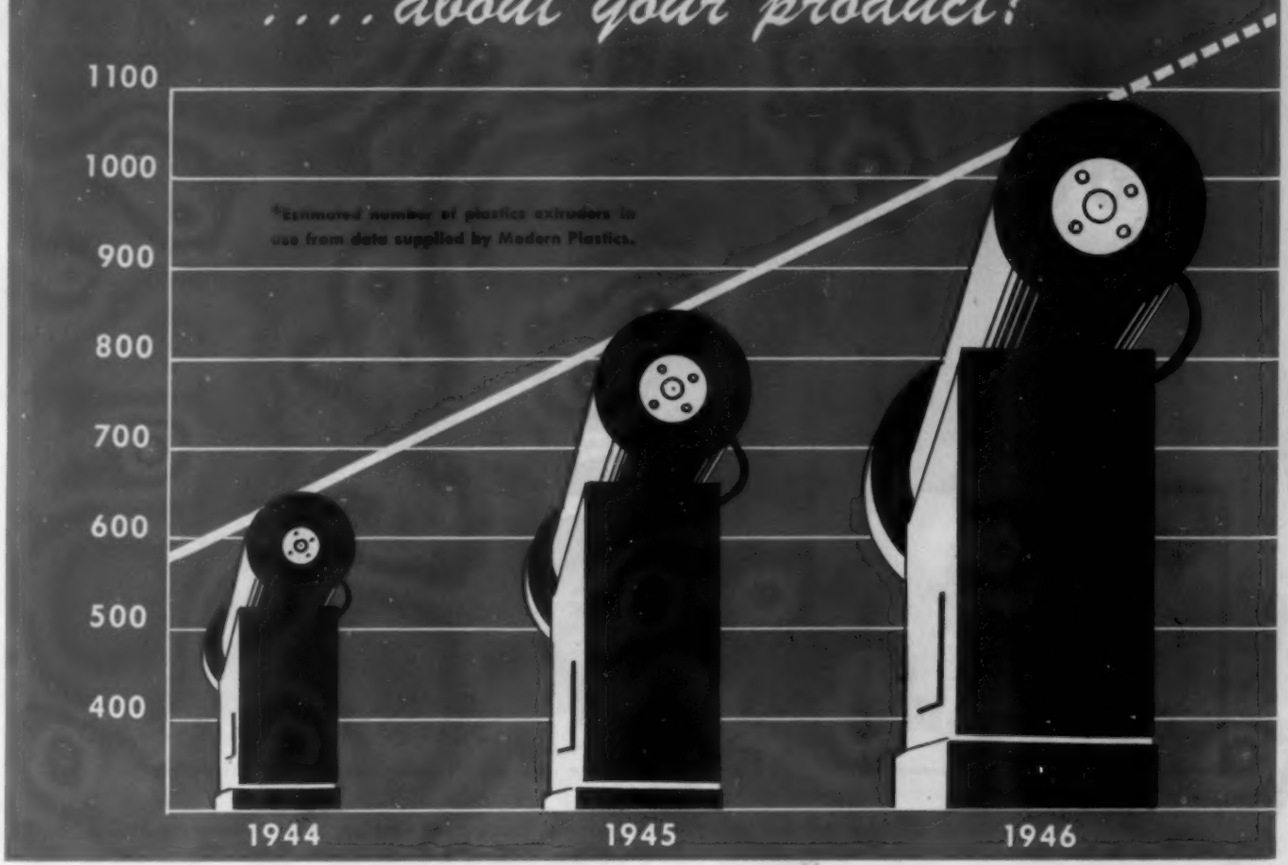
Do your product requirements include close tolerances, large volume, low unit prices *and* unusual designs? Atlantic's engineers, stimulated by the challenge of scores of difficult molding assignments, have developed the skill and ingenuity to meet the most exacting manufacturing needs. We offer close collaboration with product designers.

ATLANTIC PLASTICS Inc.

FORTIETH ROAD, FLUSHING, NEW YORK

1094* EXTRUDERS tell their own story

....about your product!



THE tremendous growth of the extrusion process says more plainly than anything else, that more and more manufacturers are finding that their plastics products can be produced cheaper, faster and better, by *extrusion.* Many plastics products now produced by extrusion were formerly made by other methods—and of other materials. The manufacturers of these products analyzed them, and often with only a slight change in design, gained all the advantages of the extrusion process:

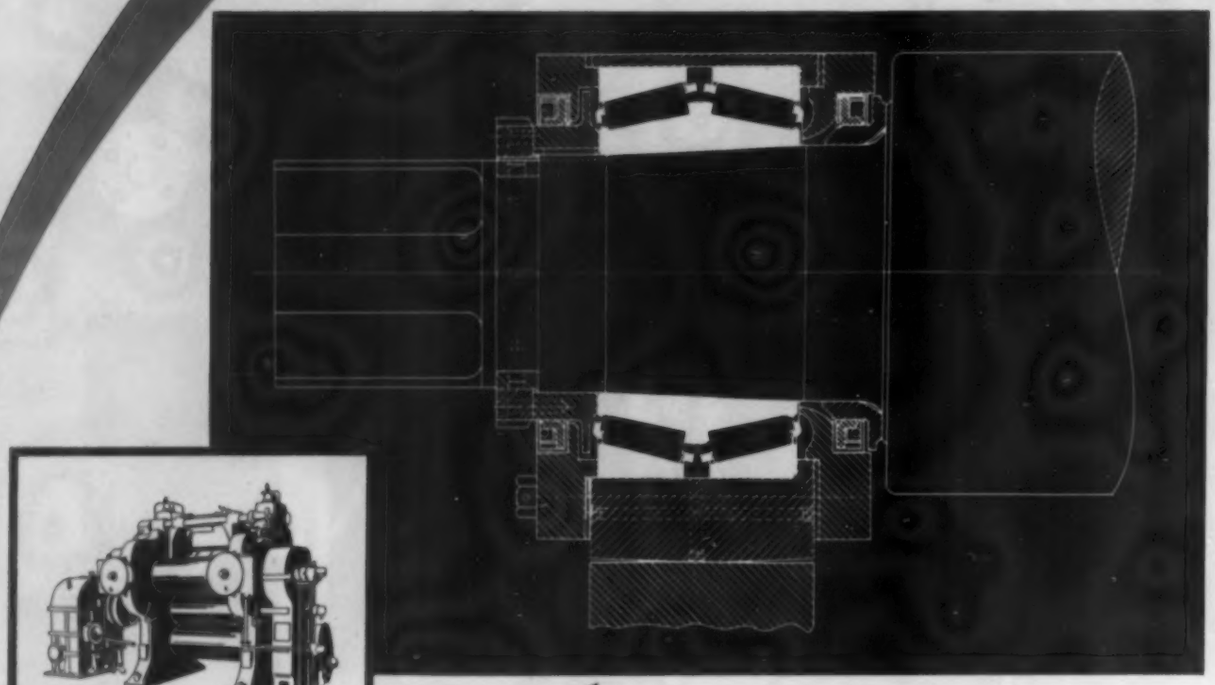
1. **Faster production.** Extrusion is a trouble-free, *continuous* process.
2. **Lower Cost.** No highly skilled labor required. Equipment is relatively less expensive than many other types of fabricating machinery.
3. **Better quality.** No buffing or polishing needed. Tolerances are precisely maintained. Physical properties are closely controlled.

To bring the advantages of extrusion at its best to your manufacturing operations, call upon National Rubber Machinery Company, makers of America's most complete line of plastics extrusion equipment.

NATIONAL RUBBER MACHINERY CO.
General Offices: Akron 11, O.

Plastics
MACHINERY DIVISION

THIS TIMKEN BEARING APPLICATION *Assures* ALL THE BEARING QUALITIES NEEDED IN PLASTICS CALENDERS



First, because the bearings themselves are manufactured to extremely close precision tolerances.

Second, because the bearings are of Balanced Proportion Design, giving increased roll neck strength and rigidity; minimum roll deflection; and maximum radial, thrust and combined load capacity.

Third, because the bearings are mounted with a tapered bore on the calender roll shaft, making it much easier to assemble the bearings on the roll shaft and to remove them when necessary.

Fourth, because the calender rolls can be ground on the bearings, making the O.D. of the calender rolls virtually free from inaccuracies, due to the internal precision of the bearings.

Fifth, because Timken Tapered Roller design assures free rolling motion regardless of the R.P.M. of the bearing or the speed of the calender rolls.

Sixth, because only with an adjustable bearing — a Timken Bearing — is it possible to provide and maintain proper running clearance for any calender operating temperature.

These features make possible accurate and constant gap setting between rolls with resulting close control of product thickness; minimum operating and maintenance costs; and longer calender life. Specify Timken Bearings for your calenders and look for the trade-mark "TIMKEN" on every bearing you use. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

48 Years of Engineering and Metallurgical Development

More Power TO PLASTICS

5000 POUNDS PER SQUARE INCH
0 to 12 GALLONS PER MINUTE
40 HORSEPOWER

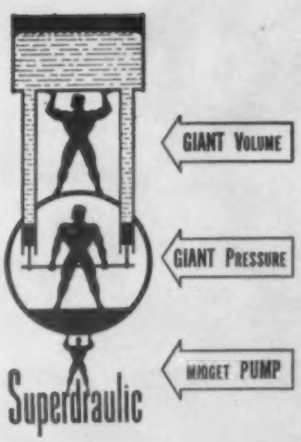
From a *Midget* pump with *Finger Volume Control*

The new Superdraulic high pressure pump can be tucked away in the base of almost any plastics machine and yet it delivers 5000 psi and 40 hp with volume ranging from 0 to 12 gpm, or 3500 psi with volume from 0 to 17 gpm at 1200 rpm—approximately double the pressure available from contemporary pumps.

And, its operation is under instantly responsive finger volume control or automatic pressure compensator control—infinitely variable volume and reversible flow. The Superdraulic pump is also available in constant delivery types.

Superdraulic engineers will be glad to work with you in applying this 100% flexible hydraulic power to your product, whether it's a machine tool, press, vehicle, locomotive, or ship.

Write for complete, illustrated technical description of Superdraulic pumps, motors, and transmissions.



Superdraulic Corporation

HYDRAULIC PUMPS • MOTORS • TRANSMISSIONS • VALVES

MILLER AT FORD ROAD — DEARBORN, MICHIGAN

"THE ~~GLASS~~ Plastic OF FASHION AND THE MOLD OF FORM"

Behind the striking effectiveness of this Helena Rubinstein "bell" package are exceptional designing skill and the finest of modern plastic craftsmanship. Injection-molded from Polystyrene, this Fisher product reproduces in intricate and accurate detail the beauty of the original design. At Fisher, designers and craftsmen who know their job . . . using the most modern machines in the industry . . . will work as a team to produce to your exact specifications. We are equipped to work with all types of plastics . . . using all methods . . . injection and compression molding, extrusion, laminating and coating. For further information write Dept. M-2, Fisher Plastics Corporation, 76 Arlington Street, Boston 16, Mass.

Export Agents: STERN, MORGENTHAU & CO., INC. 44 Whitehall Street, New York 4, N. Y.

Fisher PLASTICS CORPORATION

BEAUTY TO ENJOY—NOT PAMPER

at last . . . a new low cost HOT PRESS

LEAF STAMPING MACHINE

that makes the usual models as out of date as the Dodo

See how we've overcome all the old shortcomings!

Compare these additional new features!

Self centering type holder palate will take up to 4" x 6". Die holder palate will take larger die

Adaptable for all types of plastics.

1. Hand lever may be instantly set at any of 14 positions, to suit convenience of operator.
2. Heavily knurled, self-setting feed rolls give sure pull. No slipping—no waste. Adjustable from 0" to 5½".
3. Simple leveling adjustments for setting impression table so as to get best results.
4. Quick guide adjustments for register feeding so that you get the impression exactly where you want it.
5. Lock handle for instant height adjustment of die or type up to 8".
6. Ratchet and gear of hardened steel for long life.
7. Stroke adjustable to any height from die to impression plate.
8. Ball handle on impression bar for natural grip.
9. Correct engineering of rigid frame prevents spring.
10. A weight, counter balancing moveable parts, makes for ease of operation.
11. 2 way adjustments for feed guide control.
12. Leaf roll widths up to 6".
13. Thermostatic heat control assures exactly the right temperature for any job. This is imperative if perfection and economy are to be obtained.
14. Sliding bed for quick change from one job to another.
15. Strong intelligent construction throughout insures long life and economy.
16. Work platform—12" x 12". Larger platform available.
17. Pedal for foot operation available.
18. Dial tables available.

Always complete stocks of leaf, foils, type, dies and accessories.

Impression Products A DIVISION OF **STAMP RITE** INC.

170 BROADWAY • N. Y. 7 • RE 2-0823-4-5

"From Custom-Mold — to Custom-Material — to Custom-Processing"...

A PERFECT *Triple-Play* IN PLASTICS!

Viewed from any angle this molded case for Wilcolator* was a real challenge. Using standard finishing techniques, 34 machining operations would have been needed to produce the intricate pattern of holes, recesses, slots and lettering appearing on the *topside* alone! Not less than a dozen additional operations could have provided the fillets, bosses and stepped-planes of the inside contour. Yet by careful engineering, this part was precision molded as it appears above without recourse to a single after-molding operation. To meet the demands of the application for a heat-resistant material, we used a compound, custom-formulated in our own plant. And for speed and economy in production the cases were molded *eight-at-a-time* in an enclosed type semi-automatic mold.

In baseball parlance, facing this "tough line-up" Consolidated came up with a perfect triple play . . . from Custom-Mold to Custom-Material to Custom-Processing . . . scoring complete *customer* satisfaction. We will be glad to meet the challenge of your next plastics application with an equal display of brilliant teamwork. Inquiries invited!

*Illustration: Housing for Type "B" Electric Switch, compression molded for the Wilcolator Company, Elizabeth, N. J.

Consolidated
MOLDED PRODUCTS *Corporation*
309 CHERRY STREET, SCRANTON 2, PA.

"Your Blueprint in Plastic"

PRODUCT DEVELOPMENT • MOLD DESIGN • MOLD CONSTRUCTION • PLUNGER MOLDING • TRANSFER MOLDING • INJECTION MOLDING • COMPRESSION MOLDING
Branches: NEW YORK, *1790 Broadway* • CHICAGO, *549 W. Randolph St.* • DETROIT, *550 Maccabees Bldg.* • CLEVELAND, *4614 Prospect Av.* • BRIDGEPORT, *211 State Street.*

molded *Automatically!*

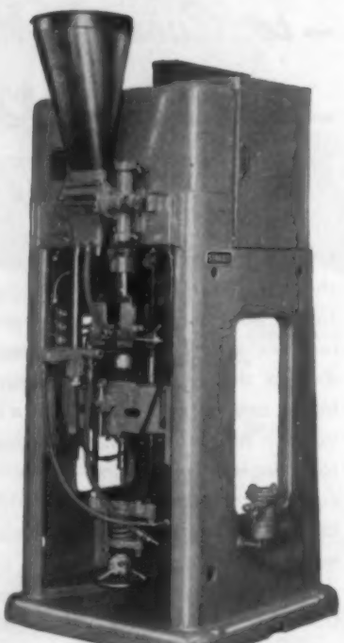
With savings of thousands of dollars per year.....

Caps for a nationally-known brand of pens and pencils used to be molded by conventional methods. The large, multiple-cavity molds needed to hold labor cost per piece within reason produced a year's supply in a few weeks. Result — heavy inventories and large mold investment lying idle.

Now these parts are molded automatically, as needed, on Stokes Presses. The savings in labor costs and inventory total several thousands of dollars per year. *Plus* an "extra" bonus — accuracy is so improved that rejects and time lost in assembly are negligible.

Investigate the demonstrated economies and competitive advantages of Completely Automatic Molding now.

F. J. STOKES MACHINE CO.
5934 Tabor Road Philadelphia 20, Pa.



(Stokes 200-D Completely Automatic Molding Press. 15 tons capacity.)

50th year of Service to Industry

F.J.Stokes MOLDING EQUIPMENT FJS Est. 1895

It's no longer a problem boys — KEYES is taking new specialty business again!

The good news is making the rounds. Amazing how many molding problems disappear at the mention of the word KEYES.

It's been a long time since we solicited new specialty business. But new equipment and expanded facilities have improved the production picture at last. We can take on a number of new specialty jobs at this time—molding to specifications and delivering products complete, ready for use. Write us about your molding problems.

No other type of material offers this unique combination of properties.

GREAT STRENGTH WITH LIGHT WEIGHT—Preformed before curing; impact strength up to 5 times that of ordinary plastics.

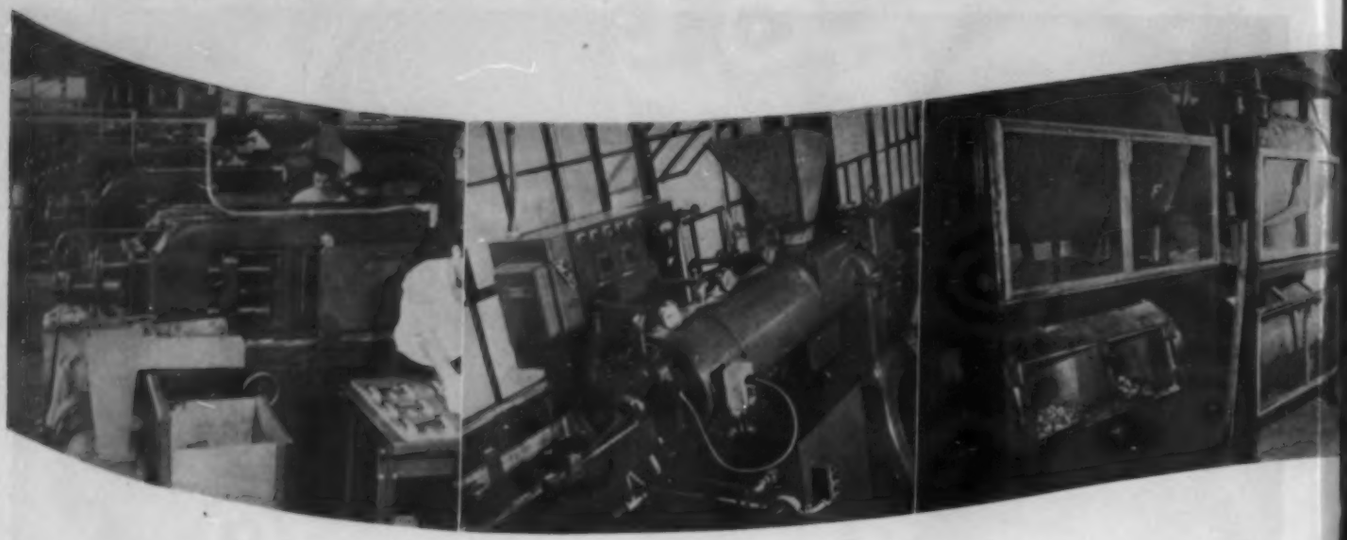
UNUSUAL ADAPTABILITY—Lends itself to large hollow pieces, complicated pieces with projections or depressions, large or small shapes with thin wall sections.

INTEGRAL COLOR AND FINISH—Highly durable, unusually resistant to abrasion, impervious to mild alkali and acid solutions.

NON-CONDUCTOR—KYS-ITE's dielectric properties are important where safety is a factor. Poor conductor of heat and cold. Non-resonant, non-reverberating.

KEYES FIBRE COMPANY
420 Lexington Avenue
New York 17, New York
Plant at Waterville, Maine

KEYES
MOLDED PRODUCTS



Complete Custom Molding

FACILITIES

immediately available!

- ENGINEERING PRODUCT DESIGN
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- EXTRUSION MOLDING
- PLASTICS FABRICATING
- FINISHING AND ASSEMBLY
- METAL STAMPING
- METAL FABRICATING
- METAL PLATING

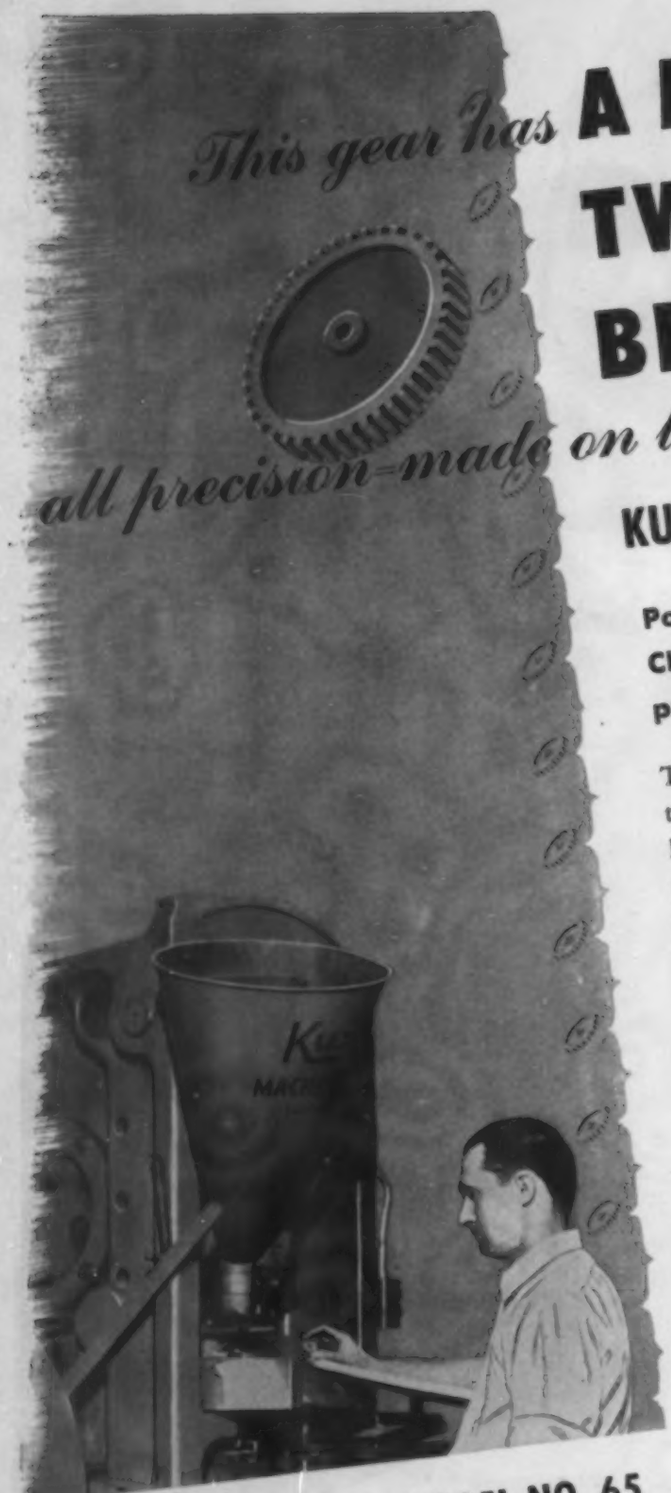
Hardy's custom molding facilities include a battery of over 50 injection presses (8 to 24 oz.) and a complete extrusion department *plus* finishing and fabricating departments for both metal and plastics assemblies. Our skilled engineering, design and mechanical staff has a priceless background of over 20 years of experience in working with both metals and plastics . . . our mold making department, completely equipped with every type of modern precision machine and staffed with highly skilled craftsmen, is geared for the quick production of complicated molds.

Tremendous capacity backed up by quality workmanship and technical know-how assures you a speedy solution to your plastics problems. A blueprint or model of your new plastics application will bring you prompt quotations on molds and molding costs. Inquiries invited.

HARDY PLASTICS & CHEMICAL CORP.

ONE JUNIUS STREET, BROOKLYN 12, NEW YORK

This is the modern Hardy Plant . . . 7-story structure — 200,000 sq. ft. Centrally located, adjacent to main-line railroad siding . . . arterial highways to all out-of-town points.



This gear has **A MILLION TWIN BROTHERS**

all precision-made on the powerful

KUX MODEL NO. 65 PRESS

Powdered Metal Products Corporation, Chicago, points with pride to this production achievement.

This small gear had to be held to close tolerances and yet had to be produced in large volume, economically and with utmost precision. PMP solved this problem with powder metallurgy and the Kux Model No. 65 Press. The record stands and speaks for itself. 1,000,000 gears made to close tolerances . . . all identical twins of perfection! Powdered Metal Products Corp. has long been a user of Kux equipment, and thus it was logical for them to depend upon Kux Model No. 65 for a job with such exacting requirements.

Kux equipment can solve your precision production problem too, whether yours be in powder metallurgy, plastics, ceramics or any of the other fields which require high speed, automatic presses.

Write for complete specifications or for demonstration appointment.

Flexible new **MODEL NO. 65**

Single Punch—75 Tons Maximum Pressure

- **Parts, maximum diameter . . . 3″**
- **Maximum depth of die fill . . . 3″**
- **Parts per minute, up to 25**
- **Horse power required, up to 10**
- **Floor space, feet . . . 3 x 4½**

KUX MACHINE CO.

3926 W. Harrison Street

Chicago 24, Illinois

Saran BY NATIONAL

OUT FRONT WITH NEW BEAUTY AND DURABILITY

SARAN tape, a beautiful and amazingly tough material, is being used in the creation of colorful enduring outdoor furniture. Extruded by NATIONAL in a wide range of glowing colors, SARAN tape may be employed in numerous combinations. It has a rich decorative luster that won't wear off. Just wash it—it sparkles like new.

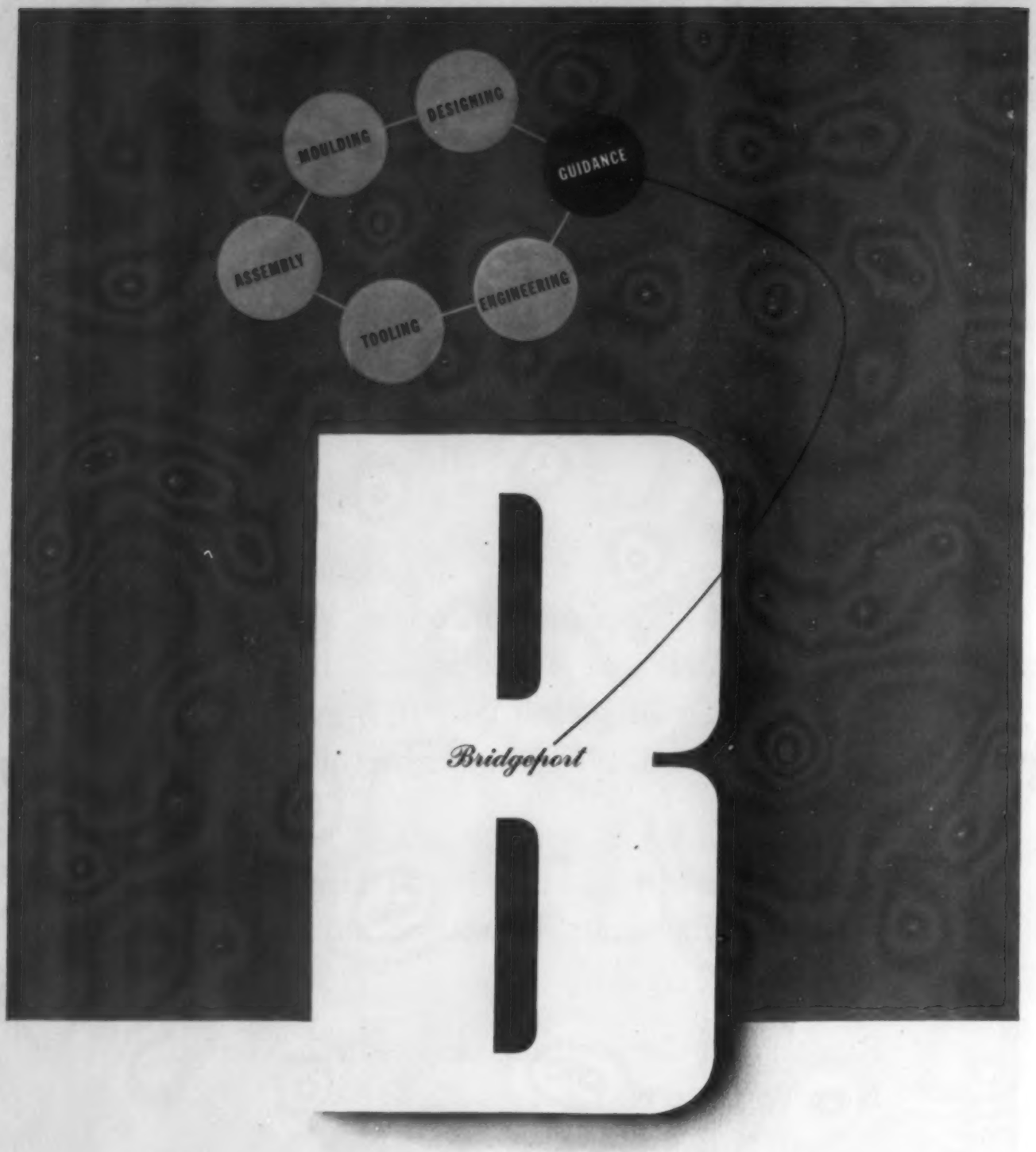
The brawniest heavyweight can sink into these chairs for perfect comfort and relaxation. SARAN tape is strong and resilient, withstands rough treatment and keeps its original shape. It won't absorb dirt, will not rot or deteriorate.

Here again, is one of the many instances in which SARAN BY NATIONAL has opened new vistas for marketing better products.

NEW YORK: EMPIRE STATE BUILDING

The NATIONAL Plastic Products Company

ODENTON • MARYLAND



Guidance is the first of many complete services we offer in satisfying your plastic needs. Selection of the proper plastic materials is of primary importance in the production of your product. For plastics . . . think of Bridgeport.

BRIDGEPORT MOULDED PRODUCTS, INCORPORATED

BRIDGEPORT CONNECTICUT

INTERLAKE *Resineering*

What is it?

Interlake ***Resineering*** is the functional engineering of a resin to meet the *specific* requirements of your job.

How is it Done?

There are four steps in Interlake ***Resineering***— **1.** Analysis of your problem followed by our recommendation. **2.** Development of a resin for your particular application. **3.** Testing this resin on the job, in *your* plant, working with *your* operating men. **4.** Stabilizing its production for continuous uniformity in performance.

What advantages Accrue?

Interlake ***Resineering*** assures dependable, uniform production at all times. It completely eliminates the expensive delays encountered when using resins which must be "adjusted" every time a new run is started.

Other important phases of Interlake's service include analytic inspection reports with each shipment and helpful consultation on your use of resins.

BASIC APPLICATIONS OF INTERLAKE RESINS INCLUDE

BONDING —wood, veneer, corestock, cellulose waste and fibrous materials.
SURFACING —wood, paper and fabric.
LAMINATING —fabric, paper and wood.
IMPREGNATING —wood, plaster and other cellular materials.

INTERLAKE will help you solve your resin problem. We also will be glad to discuss the possible advantages of adopting the use of resins in any new operation. Write Interlake Chemical Corporation, Union Commerce Building, Cleveland 14, Ohio.

INTERLAKE CHEMICAL
Corporation
• PRODUCTS FROM COAL •

SPEED CLEAN-UP! INCREASE PRODUCTION! IMPROVE FINISH!

Abolish ~~DISCOLORATION~~ ~~DISTORTION~~ ~~FLOW~~

PORTER-CABLE

WET OR DRY ABRASIVE BELT SURFACER

Does them all on PLASTICS...

FOR thermoplastics and some thermo-setting plastics, experience has shown that the PORTER-CABLE Surfacing methods are best. In Wet-Belt Surfacing, the coolant is sprayed on the belt before and after cutting, keeping it free and clean. Because there is no heat, the grindings do not "weld" and load the belt. Wet or Dry—the PORTER-CABLE Surfacing technique does a better, closer, finer job because a flexible belt follows the contour and gets into places other power tools won't reach. For repeat operations a padded platen fits the belt to the contour of the job. Round pieces, held on an arbor, rotate with the belt for perfect roundness.

MODEL B-6W — especially designed for curved or irregular work. Most jobs can be handled freehand, or with simple fixtures. A single pass in a fraction of the usual time—cuts cost and improves the finish.

MODEL WG-4—A new all-around Wet-Belt Surfacer for Job Shop, Production Line, Toolrooms—or Salvage Department!

Ideal for light operations or continuous production grinding in the plant. Grinds flat on the platen—line contact grinding on the resilient contact roll. Self-contained coolant system and re-circulating tank. Chip or clean-out drawer traps all grindings and waste. Tilted head gives free use of contact roll and full use of coolant on belt.

Most operations performed free-hand!
Runs cooler—faster—dust-free!
Machines flats—bevels—generates radii!

WRITE TODAY for a free copy of our latest handbook, "Production Man Speaks." It describes new and highly efficient ways of spreading flow of your product from the presses to the packing boxes.

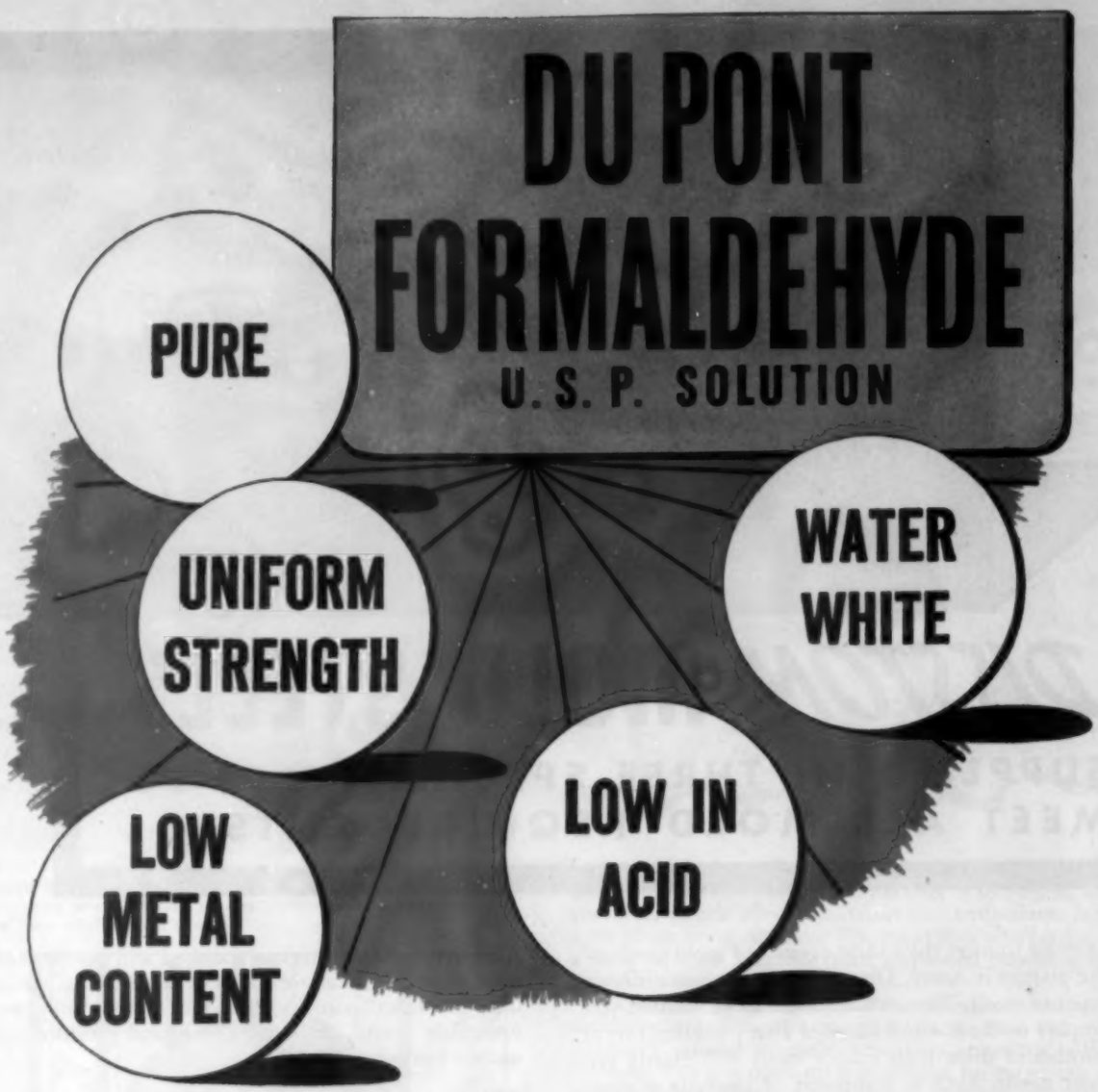
Send for film: "Machine of the Age," loaned free for factory staff meetings.

MAKES BENCH GRINDERS 3 TIMES MORE VALUABLE.

Outstanding for burring, the N-2 attachment for bench grinder (opposite) is an all-around job that provides contact grinding on the wheel . . . flat-grinding on the platen . . . or contour-grinding on the flexible belt! For the spot where the clean-up jobs are varied, you can't choose a better piece of utility equipment. Quickly adjusted to either vertical or horizontal position.

MODEL N-2

PORTER-CABLE MACHINE CO. 1606-1 N. SALINA ST. SYRACUSE, N. Y.



DU PONT FORMALDEHYDE is designed to meet the high requirements of the plastic industry. It's completely dependable—produced under controlled conditions to assure you consistently fine raw material.

DU PONT FORMALDEHYDE is shipped from the factory in tank cars or standard containers, or from stocks of standard containers maintained in principal cities.

DEPEND ON DU PONT also for your requirements of *Paraformaldehyde,* 95% minimum strength. And *Hexamethylenetetramine*—U. S. P. crystals or technical. For additional information and technical assistance, call our nearest office. Electrochemicals Department, E. I. du Pont de Nemours & Co. (Inc.), Wilmington 98, Delaware.

District and Sales offices: Baltimore, Boston, Charlotte, Chicago, Cleveland, Cincinnati, Dallas,* Detroit, El Monte (Cal.), Houston,* Kansas City,* New York, New Orleans,* Oklahoma City,* Philadelphia, Pittsburgh, San Francisco, Tulsa,* Wichita.*

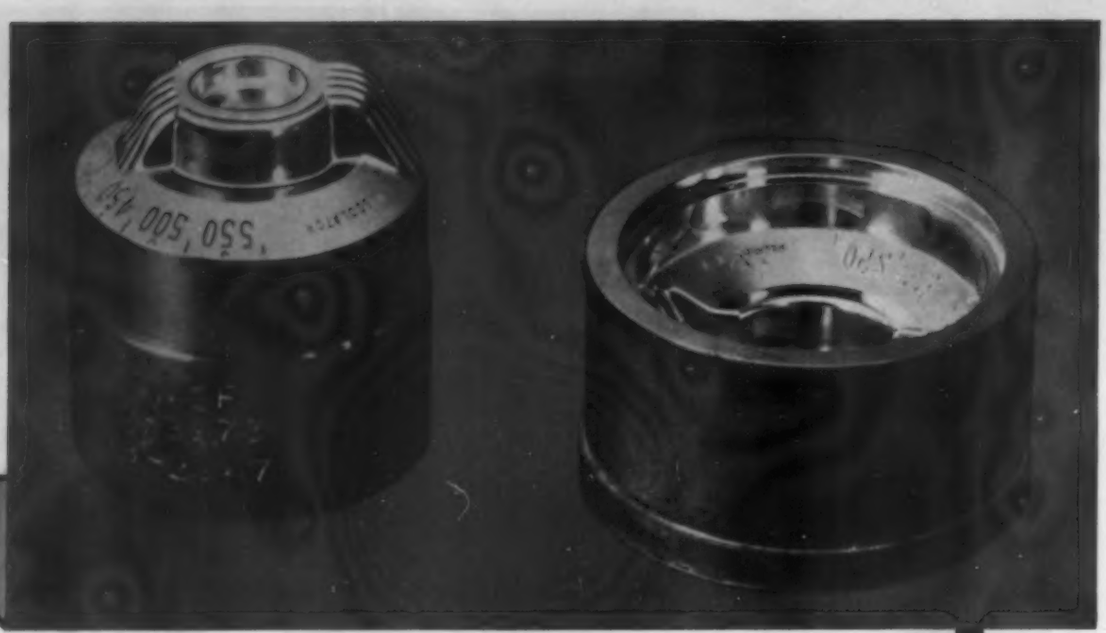
**Barada & Page, Inc.*

DU PONT ELECTROCHEMICALS

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*



DISSTON MOLD STEELS

SUPPLIED IN THREE SPECIAL TYPES TO MEET ALL MOLD REQUIREMENTS . . .

In order to meet the widely diversified mold needs of the plastics industry, Disston provides three different types of steels. Thus, whatever the basic method you employ or the size and shape of your products, one or another of these high quality steels will exactly suit your needs. Each is composed of carefully selected ingredients, and is produced in electric furnaces by modern steel practice with every process under rigid control.

DISSTON PLASTIRON . . . a low carbon iron that withstands extreme hobbing. Recommended for difficult shapes and short runs.

DISSTON PLASTALLOY . . . a low carbon steel containing sufficient nickel and chrome to assure great core strength and resistance to wear, yet permit easy hobbing. Recommended for medium runs and a wide variety of products.

DISSTON PLASTIKUT . . . a "cut mold" steel with alloy content for maximum core and case strength. Because of its hardness, Plastikut must be machined instead of hobbed, but its ability to stand up under long runs makes its use economical.

All Disston Mold Steels are melted and hot-worked with great care, and are specially inspected to assure freedom from porosity and inclusions. They are uniformly sound, carburize evenly and produce unusually smooth cavities.

Whatever your mold or hob problems, Disston engineers and metallurgists will be glad to help you solve them.

Write for Folder

Tells what to look for and what to avoid in selecting mold and hob steels. Also contains analyses of Disston Mold and Hob Steels and other helpful information.

HENRY DISSTON & SONS, INC., 134 Tacony, Philadelphia 35, Pa., U. S. A.

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NEW ENGLAND
Achorn Steel Company
381 Congress Street, Boston 10, Mass.

METROPOLITAN NEW YORK AND NORTHERN NEW JERSEY
Bright Steel Corporation • Offices & Warehouses: 528-540 W. 22nd St., New York 11, N. Y. 224-236 Culver Ave., Jersey City 5, N. J.

Thermatron*

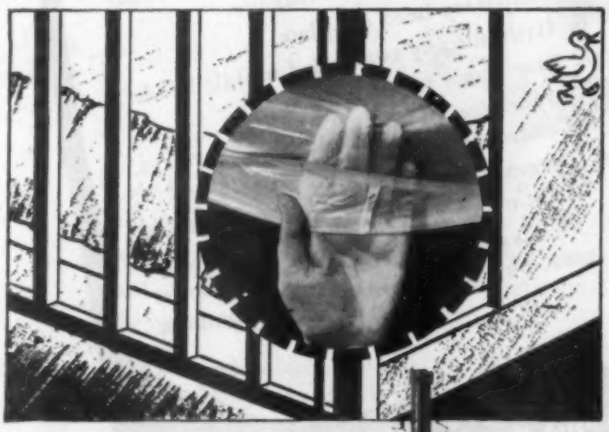
"The Outstanding Development"

FOR MAKING

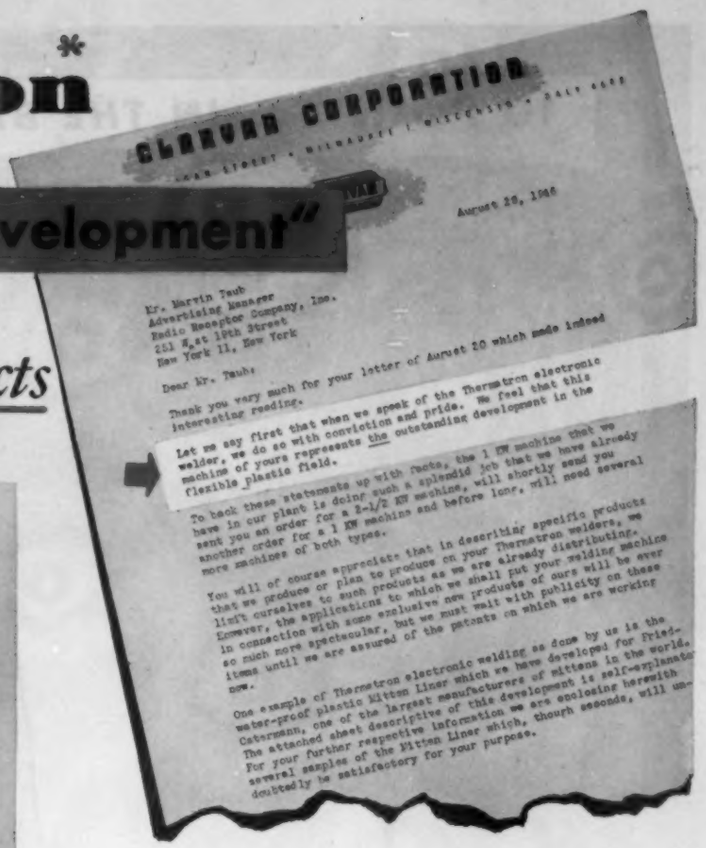
Sealed Plastic Products

LIKE THESE!

100% water-proof, air-tight plastic mitten-liner, THERMATRON-sealed by Clarvan. "Enthusiastically received . . . constantly increasing sales," Clarvan reports. Electronically welded seams eliminate stitches, add strength.



Plasticoid Crib Sheet with corners electronically welded with THERMATRON. "Ideal construction for perfect fit," says Clarvan, "Durability far superior to any other design."



CLARVAN CORPORATION

August 28, 1946

Mr. Marvin Taub
Advertising Manager
Radio Receptor Company, Inc.
251 W.st 19th Street
New York 11, New York

Dear Mr. Taub:

Thank you very much for your letter of August 20 which made indeed interesting reading.

Let me say first that when we speak of the Thermatron electronic welder, we do so with conviction and pride. We feel that this machine of yours represents the outstanding development in the flexible plastic field.

To back these statements up with facts, the 1 KW machine that we have in our plant is doing such a splendid job that we have already sent you an order for a 2-1/2 KW machine, will shortly send you another order for a 1 KW machine and before long, will need several more machines of both types.

You will of course appreciate that in describing specific products that we produce or plan to produce on your Thermatron welders, we limit ourselves to such products as we shall put your welding machine to. However, the applications to which we are already distributing, in connection with some exclusive new products of ours will be ever so much more spectacular, but we must wait with publicity on these items until we are assured of the patents on which we are working now.

One example of Thermatron electronic welding as done by us is the water-proof plastic Mitten Liner which we have developed for Friedman, one of the largest manufacturers of mittens in the world. The attached sheet descriptive of this development is self-explanatory. For your further respective information we are enclosing herewith several samples of the Mitten Liner which, though seconds, will undoubtedly be satisfactory for your purpose.

Again a famous manufacturer reports enthusiastically on THERMATRON for making water-tight, air-tight seams on plastic products. *Again* this enthusiasm is backed up with an order for *more* THERMATRON equipment! *Again* a story of how THERMATRON improved products, stepped up sales, PROFITS!

Investigate THERMATRON. *You* can make seams in plastic products strong as the material itself. *You* can increase product's tensile strength, eliminate stitching, adhesives, solvents. *You* can open up possibilities for hundreds of new profit-making plastic specialties . . . with THERMATRON.

THERMATRON electronic sealing is the fast, modern, low-cost way to seam handbags, cushions, shower curtains, beach toys, raincoats, shoes . . . many other plastic products, too.

THERMATRON Dielectric Heaters, self-contained and ready to use, are also available to molders for heating plastic preforms, plywood, rubber, and for general purpose use.

Write on your letterhead for your free copy of "Electronic Heating and Sealing With the Thermatron." This 8-page bulletin illustrates and describes in detail THERMATRON industrial electronic heat generators for sealing and preheating. Address Dept. T-31.

Thermatron* DIVISION

RADIO RECEPTOR CO., INC.

Since 1922 in Radio and Electronics

251 West 19th Street
New York 11, N. Y.

Midwest Sales & Service: Zephyr Electronics, Chicago

*Reg. Trade Mark

Look to MACOID For Plastics Engineering

MACOID plastics engineers are accustomed to thinking in terms of production. To them, ease and economy of production and assembly in your plant are just as important as a product's appearance or other use values.

The extruded automotive trim strip shown above is a typical example of MACOID plastics engineering. After extrusion, these strips are cut to length, punched, and applied to curved metal backing pieces in the MACOID plant. The result is a complete unit which is easily attached by the body manufacturer—providing a colorful interior decoration with no additional assembly problems.

MACOID will do this type of job for you, too. Consult the MACOID staff for engineering assistance on your product. There is no obligation.

DETROIT MACOID CORPORATION

Originators of Dry Process Plastics Extrusion

12340 CLOVERDALE • DETROIT 4, MICHIGAN • • •

EXTRUSION AND INJECTION MOLDING

New! F-A-S-T

FULL POWER-OPERATION without MOTORS or PUMPS

The Amazing ELMES HYDROLAIRS

(Patents Applied For)

A New Operating Principle . . . New Effortless Performance, New Economy . . . for Plastic Molders

Bulletin 1036 gives Models, Sizes, Capacities, Dimensions, and Complete Specifications. It's yours for the asking.

ELMES
Since 1851
HYDRAULIC EQUIPMENT

Elmes has "done it again" with a *brand new principle* for powering hydraulic presses—and it's exclusively Elmes! Gone are the motor and pump. Gone are cumbersome bulk and weight. New Elmes Hydrolairs take their power *entirely* from the shop air line.

Hydrolairs give you *effortless* lever control; *rapid* platen advance; maximum pressure instantly. They apply and maintain any desired pressure—and *repeat* at that pressure until reset.

Economical to Buy and Use

Individually, or in the line, these time-saving, money-saving small presses do *big jobs.* Power for operation costs less than *one-fiftieth* of a penny, per average cycle. Made in capacities to 50 tons, and in bench-type and floor-type models. Find out today how Hydrolairs can cut *your* costs.

ELMES ENGINEERING WORKS *of* AMERICAN STEEL FOUNDRIES • 225 N. Morgan St., Chicago 7, Ill.

METAL-WORKING PRESSES · PLASTIC-MOLDING PRESSES · EXTRUSION PRESSES · PUMPS · ACCUMULATORS · VALVES · ACCESSORIES

SHAW-MOLDED FOR SHAVING COMFORT

Schick's Shaver has the smooth lines and sturdy construction that show sound plastics design and application, and is another molding achievement by Shaw in which materials and technique have been combined to help produce a top-notch product in plastics.

Five plastics components, produced from three different materials, are molded by the Shaw Insulator Company for the Schick Shaver. Each material was selected for specific properties essential to pleasing appearance, long life and trouble-free operation. Each mold was effectively designed and built. And the actual molding follows with the economies that can be effected by up-to-date presses and skilled personnel, guided by over a half-century of molding experience.

Shaw engineers can analyze your plastics problems and give you sound advice in the selection of any material and any molding process for the low-cost production of your plastics products. Shaw molding facilities can serve you today as they have served Schick, Incorporated for the last twenty years.

SHAW

SHAW INSULATOR COMPANY

MOLDERS SINCE 1892

160 COIT STREET IRVINGTON 11, N. J.

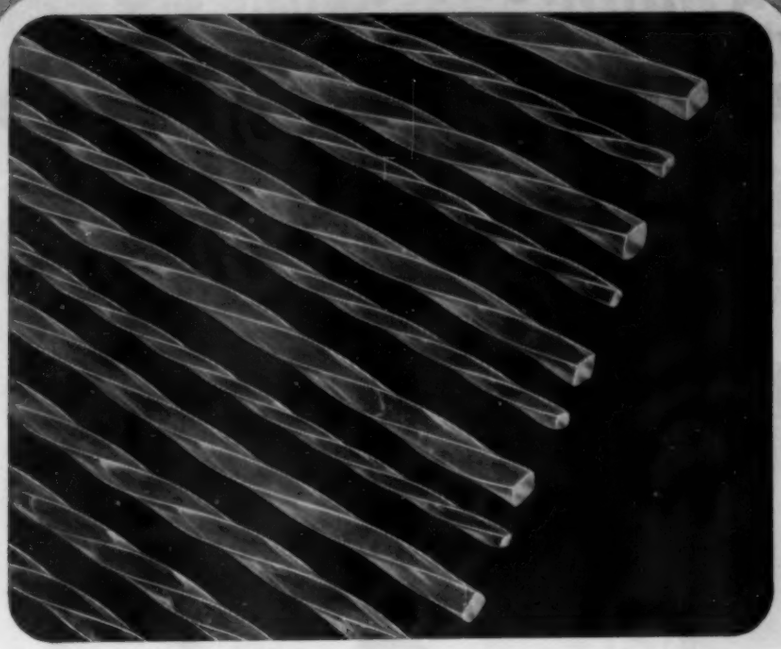
PLASTICS LITERATURE AVAILABLE

Shaw engineers have prepared a variety of literature, study of which might help you to a decision. Simply write a note about what phases of plastics especially interest you.

Or, you may prefer at once to call in a Shaw engineer, and present your problems for his study. This company's fifty-five years of plastics experience gives him a rich background from which you can draw.

Between the resources of Shaw and the Plax Corporation, Hartford 5, Conn., you can obtain assistance in almost all plastics methods and materials.

TWISTED SQUARE POLYSTYRENE ROD AVAILABLE



Plax is now producing square extruded polystyrene rod in twisted form. The striking appearance and unusual optical properties of the new shape make it ideal for displays, interior decoration and for creating special ornamental effects on table lamps, furniture, etc.

Unlike cut and twisted sheet, Plax twisted rod does not lose the twist when used where moderate heat is present but retains it to the softening point of the material itself.

Clear twisted Plax polystyrene rod is available for immediate delivery — colored rod on extended delivery. It may be had in thicknesses ranging from ⅛" through ¾" in sixteenth-inch graduations.

WRITE FOR THIS POLYSTYRENE DATA

How to Machine Plax Polystyrene Products.
How to Use Coolants with Plax Polystyrene Products.
How to Cement Plax Polystyrene Products.
How to Polish Plax Polystyrene Products.
Notes on Design and Assembly of Plax Polystyrene Products.
Die-cut Parts from Plax Polystyrene.
How to Form Plax Polystyrene Rod.

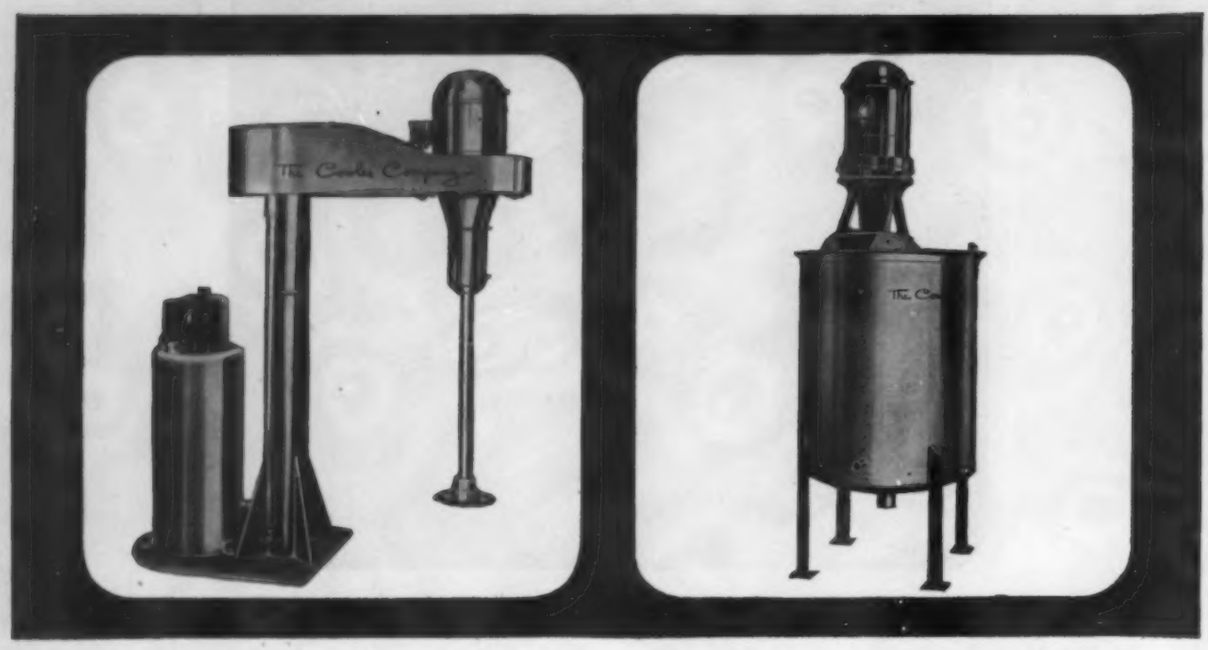
AND THIS PRODUCT INFORMATION

Data Sheets on Plax Cellulose Acetate, Cellulose Acetate Butyrate, Methacrylate, Polyethylene, Polystyrene and Ethyl Cellulose Products.
Article on Plax's Blown Products.
New special plastic shapes by Plax.

PLAX
FOR PLASTICS
NOT SUBSTITUTES···IMPROVEMENTS

133 WALNUT STREET ★ HARTFORD 5, CONNECTICUT

Now—dissolve or disperse 25 minutes to 10½ hours faster



COWLES DISSOLVER

the high-speed machine with molecular-scrubbing action

Two to twenty times faster than conventional mixers, the scientifically designed impeller of the Cowles Dissolver turns at a high rate of speed. It sets up components of laminar flow, resulting in interface shear between multiple surfaces of molecular thickness, each moving at a rate different from its neighbors. The high velocity gradients of these laminae subject every particle of the materials being treated to molecular tensions and scrubbing, greatly accelerating the dissolving or dispersing action, holding undissolved residues to low levels and producing more homogenous mixtures. High viscosities improve the dissolving and dispersing action.

Safe, Silent, Long-Wearing

Sound design and rugged structure . . . plus finely machined materials of high physical properties . . . all assure maximum life with minimum maintenance requirements. A high degree of static and dynamic balance has been achieved in the rotating parts, eliminating noise, vibration, splash and dead spots. Turbulence and aeration are thus held at low levels, though controlled aeration can be had if desired.

Models With or Without Tanks

In two models—with built-in tanks in capacities of 100 gallons, 250 gallons and 500 gallons, or for use in tanks brought to the machine. Motor speed and horsepower adjusted to the need. Explosion-proof motors on special order. Write for descriptive folder, or ask for a technical representative to call.

5 Years of Commercial Test Show Cowles Dissolver Up to 10½ Hours Faster on Typical Operations

Type Operation	*Material*	*Cowles Dissolver*	*Standard Mixer*
Gum Cutting	Rosin	1½ Hrs.	12 Hrs.
Synthetic resin dissolving	Vinylite	1 Hr.	6 Hrs.
N/C solution	Nitrocellulose	12 Min.	90 Min.
Tinting	Enamel	5 Min.	30 Min.
Pigment dispersion	Heavy enamel	6 Min.	150 Min.
Coating suspension	H. T. Clay	1 Hr.	9 Hrs.

The Cowles Company Cayuga, N. Y. *Associate: Alexander Flock, Ltd., Ottawa, Ont.*


Resproid Plastics... are Made Here!
Resproid
TRADE MARK REG.
the magical plastic material—unsurpassed in beauty and quality for fabricating shower curtains, rainy day garments, food covers, upholstery, luggage and a host of other things.
Manufactured under constant laboratory control.
Here, in this modern plant, the magic of RESPROID is made and discriminatingly sold to do specific jobs.
RESPRO INC.
CRANSTON 10, RHODE ISLAND
Genuine Resproid Plastic

This booklet belongs on the desk of every designer, engineer, production chief and purchasing agent in plastics. Send for it.

PLASTICS THAT **GLOW** IN THE DARK . . . MEAN SALES THAT GROW IN THE DAY!

VIOLITE*

LUMINESCENT PHOSPHORESCENT FLUORESCENT PIGMENTS

Plastic products that *glow in the dark* have tremendous sales appeal. This has been proved time and again with dials, knobs, signs, markers, wall-plates, tools, radios, toys, novelties, etc. There may be many items you are now manufacturing, or planning to manufacture, that will benefit by this simple improvement. And it *is* simple! Merely specify the addition of VIOLITE Phosphorescent or Fluorescent Pigments when ordering your plastic molding powders. If you are not completely familiar with the many possibilities offered by VIOLITE send for this free booklet today.

WHEN ORDERING MOLDING POWDER

SPECIFY *VIOLITE*...

You need no extra equipment... your unit production cost is not appreciably increased... you need not alter your production methods... our technical experts will gladly advise you how VIOLITE can be used in your own products.

Sun CHEMICAL CORPORATION

VIOLITE
LUMINESCENT PIGMENTS
PHOSPHORESCENT • FLUORESCENT

RHODE ISLAND LABORATORIES, INC.
AN AFFILIATE OF SUN CHEMICAL CORP.
100 PULASKI STREET, WEST WARWICK, R. I.

Reg. U. S. Pat. Off.

How PLASTIC are Your PROFITS?

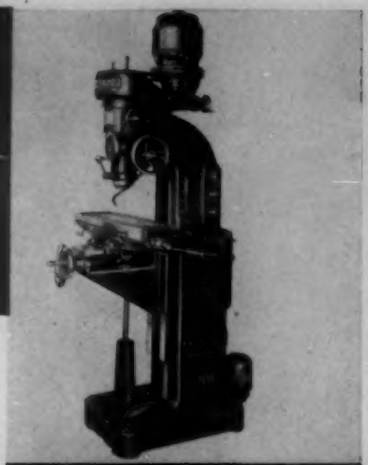
MODEL 75 TRANSFER MOLDING MACHINE

75 tons, 4 oz. capacity. Vertical type. Preheating, preforming and molding combined in one compact automatic unit, electrically controlled, fast cycling. All operations controlled from one station. Packs a lot of production into small floor space.

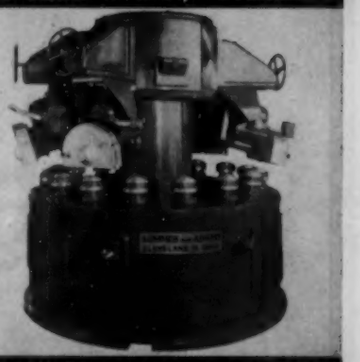
Model 250-V-10 vertical molding machine is supplied in 6, 8 or 10 oz. capacities.

Model 350-V-16 vertical molding machine is supplied in 12 or 16 oz. capacities.

Models 250-V-10 and 350-V-16 not shown are of the "Quad" four-purpose type and are automatic, hydraulically operated and electrically controlled.

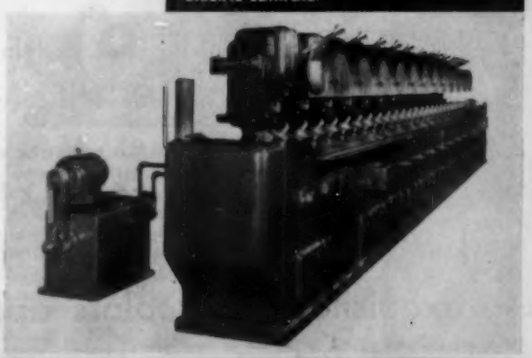


S & A No. 1 Standard Vertical Milling Machine. Prompt delivery. Widely used for mold and die making. Takes milling cutters up to 2½". Twelve spindle speeds 100 to 1750 RPM. Larger size available. Get descriptive bulletin.



S & A Special Eight Station Rotary Polishing Machine. Fully automatic, can be designed for any number of steps of progressive finishing round or cylindrical product, at 200 to 1000 pieces per hour depending upon operations.

S & A Special Polishing Machine. Adaptable to a variety of finishing operations. Each machine designed for a special application. Can be set up for high production. Hydraulic and electric controls.



"Operating margins" in the plastics industry, like many of the materials used, can become waste unless skillfully molded into useful form . . . profits.

Sommer and Adams' specialty is showing ways to mold profits, by developing every mechanical improvement in your manufacture that is consistent with its functional limitations and with the scope of your sales outlet. We call this Productioneering—simultaneous planning of product and production method for high output, low unit cost.

Above is one of the several plastic molding machines we manufacture, designed for that same purpose. At right, examples of S & A special machines, each with a cost-saving goal of its own. Variety of special machinery S & A can design and build is limited only by the scope of the problems you submit. Sharpest way to prove our performance on such a boast is to write, wire or phone, the first time you need cost cut. (KEnmore 0810 Cleveland)

S&A

THE SOMMER AND ADAMS COMPANY

18521 EUCLID AVENUE · CLEVELAND 12, OHIO

Custom-Built EQUIPMENT FOR MANY PURPOSES

SUBSIDIARY OF THE FEDERAL MACHINE AND WELDER COMPANY

intricate metal shapes made inexpensively

Now the fanciest metal shapes, imaginable, can be made quickly and inexpensively. Molded or fabricated plastics Metaplated precisely to any desired thickness with any kind of metal finish offer manufacturers the ideal method of large scale production of fine merchandise at low cost. Metaplast has many processes for metal finishes on plastics . . . our engineering department will be glad to discuss such problems with you.

☆☆☆exquisite shiny colors applied to roll acetate or cellophane☆☆☆

Metaplast COMPANY INC.
205 W. 19th ST., N. Y. 11, N. Y.

California: 1027 N. Seward, Los Angeles 38 / ENGLAND • FRANCE • CANADA • ARGENTINA • BRAZIL • AUSTRALIA

METAL PLATING ON PLASTICS

TOP SPEED ASSEMBLY

with AIR POWER FOR SMALL SCREWS!

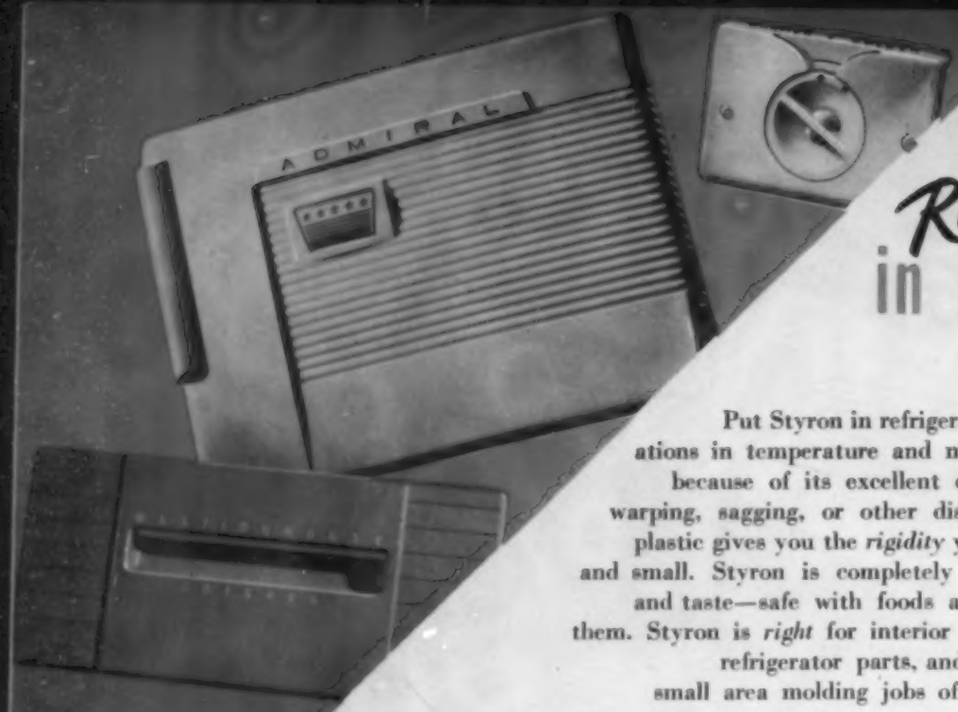
Actual Size

Now—you can drive small screws with *greater speed* and *less fatigue* than ever before—and *cut costs!*

This sensational new Aro Model 7000 Air Screw Driver does it! Check these ARO-engineered features: 1. Clutch action prevents stripping of screws and insures positive torque. 2. Automatic throttle control—merely push down and tool starts—lift off, tool stops. 3. Small size allows mounting in gang or multiple driving fixtures to drive more than one screw at a time. 4. All steel construction insures a long life of trouble-free service.

Get this ARO Air Screw Driver *now* to *save time* in assembly of radios, cameras, electrical appliances, instruments, recording devices, typewriters, many other products. Depend on ARO Air Tools for all types of screw-driving, nut-setting, drilling, grinding and similar jobs. See your Aro Jobber. Write for catalog. The Aro Equipment Corporation, Bryan, Ohio.

Specify ARO AIR TOOLS



RIGHT— in refrigerators!

Put Styron in refrigerators and it *stays* put. Ice box variations in temperature and moisture do not affect Styron because of its excellent dimensional stability. There is no warping, sagging, or other distortion. This economical Dow plastic gives you the *rigidity* you need here, in parts both large and small. Styron is completely neutral in odor and taste—safe with foods and impervious to them. Styron is *right* for interior and exterior refrigerator parts, and for large and small area molding jobs of many kinds.

design with

RIGHT— in radios!

New design ideas *work* with Styron. Here is the material that gives you full freedom to create the design innovations so important in competitive fields like radio and phonograph manufacturing. Low-cost Styron's striking beauty, both in the clear state and in brilliant colors, is another major sales appeal factor. Its fine dimensional stability and electrical properties are *right* for functional elements, as well as exterior parts. Moreover, Styron is light in weight—yielding more pieces per pound—with the durability for lasting service.

let's work it out together

Success in plastics is best measured in end products. It calls for combined efforts of manufacturers, designers, fabricators, raw material producers. Dow is ready to do its part. Save time and money—call on Dow and get the most out of plastics.

RIGHT—
in clocks!

Styron clock cases—and housings of every kind—keep their shape, their excellent surfaces, their *appeal.* Styron has the qualities you need for dependable, functional housings: rigidity, stability, durability. It has the added consumer advantages of attractive color and smooth, warm feel. Most important, Styron is the outstanding low-cost, lightweight material in the field of quality plastics. When you design with Styron you design for sales appeal, for performance, for economy.

STYRON

THE RIGHT Plastic!

ASK MOST ANY MOLDER!

Manufacturers everywhere are launching new products . . . giving old products new qualities . . . solving production problems . . . with Styron. Behind these manufacturers stand the plastics molders—experts whose business success depends on results they get from plastic materials. Whether your product needs would best be served by Styron or other plastics, your molder is the man to ask. He knows the special qualities of Styron. And he knows, too, that Dow stands ready always to consult with him—and with you—in product planning . . . that Dow will give you unmatched engineering assistance in plastics application. Call the nearest Dow office, if you like—or *ask most any molder!*

STYRON USES

Lighting fixtures and displays; electrical insulation; battery cases; funnels; closures; pharmaceutical, cosmetic, and jewelry display containers; jewelry; advertising novelties; refrigerator parts; pencils; lenses; decorative objects and trim; drapery hardware; bathroom fixtures; photographic equipment; cabinet hardware; lamp finials; housings; picture frames; housewares; toys; rounds; children's feeding dishes; tumblers; poker chips; radio parts; bathroom tile.

PROPERTIES AND ADVANTAGES

Beautiful, clear, transparent to opaque; resistant to acids and many alkalies; stable at low temperatures; excellent electrical properties; broad color range; low specific gravity, providing more moldings per pound of material; low water absorption.

DOW
PLASTICS
STYRON • ETHOCEL
ETHOCEL SHEETING • SARAN • SARAN FILM

PLASTICS DIVISION • THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN
New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago • St. Louis
Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Ontario

Personalized Lighting . . . Instantly! DAZOR ALONE *Floats!*

CONCENTRATED light exactly *where* and *when* you want it! Light of the right *quality* and *quantity*, positioned so you can see the details of fine work quickly, with comfort and ease! Such are the advantages of Dazor, the *floating* lamp.

With your finger tips you simply float Dazor into the position desired. Lift your hand and the light *stays put* . . . automatically. A patented balancing mechanism makes further adjustment unnecessary. Dazor alone *floats*.

Provide personalized Dazor lighting for every task in your plant or office which requires precise, accurate seeing. Increase the efficiency and productivity of your workers, reduce accidents and waste.

Phone YOUR DAZOR DISTRIBUTOR . . . let him demonstrate Dazor seeing benefits. For your distributor's name, if unknown to you, write to Dazor Manufacturing Corp., 4481-87 Duncan Ave., St. Louis 10, Mo. *In Canada* address inquiries to Amalgamated Electric Corporation Limited, Toronto 6, Ont.

No squinting or nervous muscular tension here—the work area is brilliantly Dazor-lighted.

With "personally-fitted" Dazor lighting, this diamond setter adds the finishing touches to a ring mounting.

Instantly adaptable to the seeing conditions required, Dazor lighting permits speedier treatment of first aid cases.

DAZOR *Floating* LAMPS

FLUORESCENT *and* INCANDESCENT

Unique LESTER FEATURES BOOST

PLASTIC PRODUCTION IN MICHIGAN PLANT

• This husky 16 ounce LESTER Injection Molding Machine is one of a group of four in continual operation at the Benton Harbor Plant of Modern Plastics Corporation. "You may quote us," said Sales Manager C. W. Abbott. "We are proud of our LESTERS and the production records they have set."

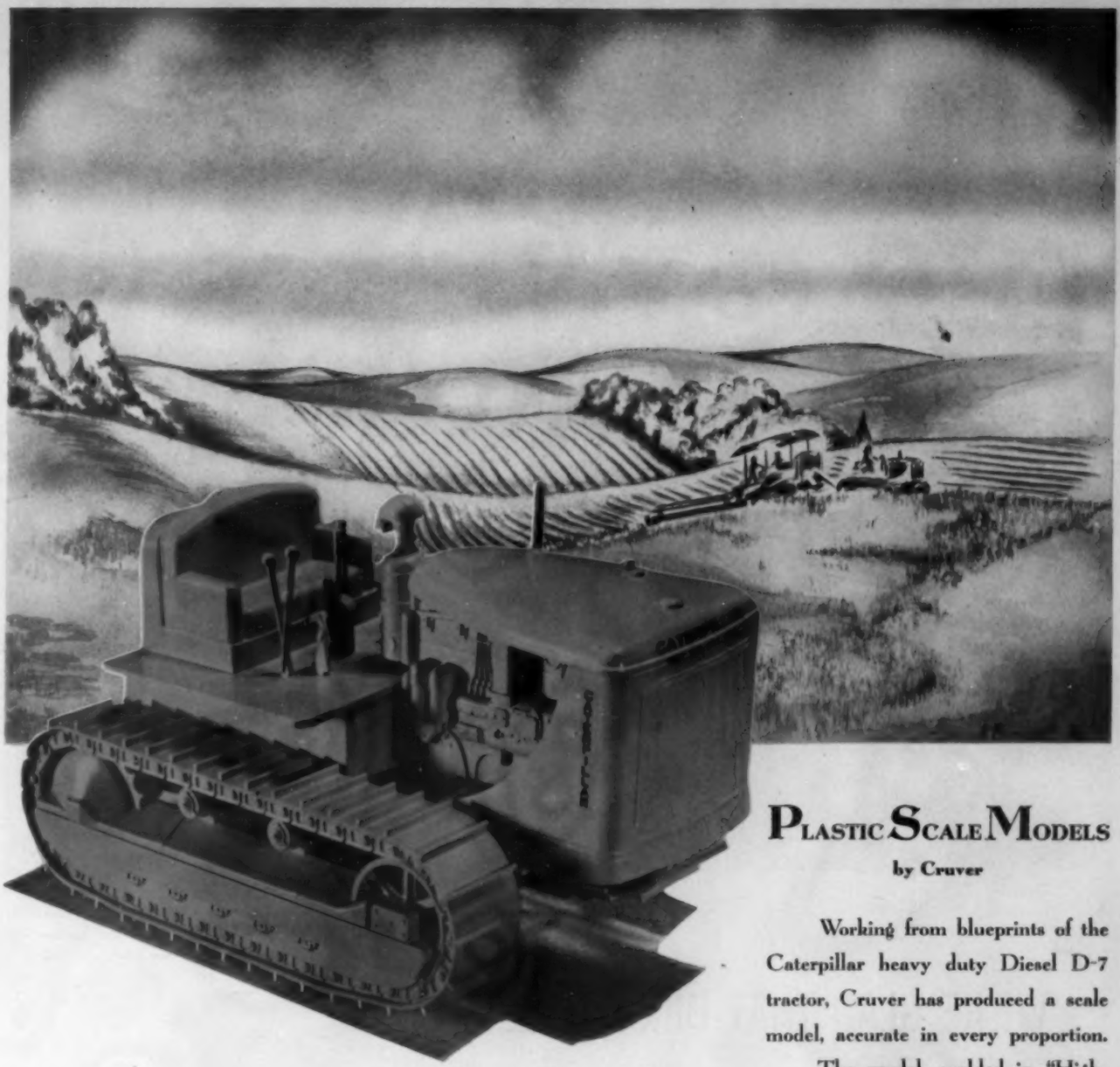
• The picture clearly shows the easily adjusted, vertical injection system and the sturdy beam-type construction—outstanding production features for proud LESTER owners.

• Literature covering the many exclusive features of the new LESTER line and suggestions for boosting plastic production is yours for the asking. . . . Won't you WRITE for it TODAY?

INJECTION MOLDING MACHINES

Distributed by **LESTER-PHOENIX, INC.**

2621 CHURCH AVE., CLEVELAND 13, OHIO



Plastic Scale Models

by Cruver

Working from blueprints of the Caterpillar heavy duty Diesel D-7 tractor, Cruver has produced a scale model, accurate in every proportion.

The model, molded in "Highway Yellow" Acetate, brings forth every fine engraving detail making it truly a replica of the world renowned Caterpillar Diesel Tractor.

Services of the Engineering Staff which developed and produced the fine model for the Caterpillar Tractor Company of Peoria, Illinois, are available to any industrial customer. We invite your inquiries.

CRUVER CHICAGO

51st Year in Plastics . .

Cruver

MANUFACTURING COMPANY

2456 W. Jackson Blvd., Chicago, Ill., Seeley 1300

New York – 2 W. 46th St. • Wisconsin 7-8847

CRUVER CHICAGO

Drop-wire undergoing abrasion tests in birch thicket "laboratory." Below, the new drop-wire, now being installed.

WE'RE GLAD THAT BIRCH TREES SWAY

The telephone wire which runs from the pole in the street to your house is your vital link with the Bell System. More than 17,000,000 such wires are in use.

The wire becomes coated with ice; it is ripped by gales, baked by sun, tugged at by small boys' kite strings. Yet Bell Laboratories research on every material that goes into a drop-wire—metals, rubbers, cottons, chemicals—keeps it strong, cheap, and ready to face all weathers.

Now a new drop-wire has been developed by the Laboratories which lasts even longer and will give even better service. It has met many tests, over 6 or 7 years, in the laboratory and in field experiments. It has been strung through birch thickets—rubbed, winters and summers, against trees, and blown to and fro by winds. In such tests its tough cover lasts twice as long as that of previous wires.

House by house, country-wide, the new wire is going into use. Wire is only one of millions of parts in the Bell System. All are constantly under study by Bell Telephone Laboratories, the largest industrial laboratory in the world, to improve your telephone service.

BELL TELEPHONE LABORATORIES

EXPLORING, INVENTING, DEVISING AND PERFECTING FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE

1922
25th
ANNIVERSARY
1947

Get Closer to the Goal with Gering

where

TEAMWORK

achieves results—

It's the combined knowledge of scores of practical plastic technicians that provides "the Gering touch" in making prime powders, and vitalizing waste and residue with high value for specific end-use.

GERING goes further than mere grinding, sorting, de-metalizing and coloring of so-called plastic waste. That's why so many plastic fabricators turn to Gering to get full measure of value.

Send in samples of your scrap for end-use suggestions and quotation. We buy outright, or rejuvenate and return your lot for re-use.

REJUVENATORS OF THERMOPLASTIC *Scrap*

CELLULOSE ACETATE—BUTYRATE—VINYL—
ETHYL CELLULOSE—POLYSTYRENE

Telephone: CRanford 6-2900

PLASTIC MATERIALS

GERING PRODUCTS, Inc.

NORTH SEVENTH ST. KENILWORTH, N. J.

"Masters of Magic in Thermoplastic conversion"

"Might I Suggest We Postpone This 'Til We Get a Plastic Brush, Pop?"

FREE!

We've got something you might like to have—a special Decimal Chart, 3-ring punched to fit your notebook. This chart gives diameter, area, and circumference of circles, and surface and volume of spheres for each additional fractional increment (1/64) of diameter. Write us on your company letterhead for your copy.

EVERY so often, we take a spanking too because we're human like you and so are not one hundred per cent perfect.

As a matter of fact, you'll find we're always willing to stick our necks out even to the extent of recommending the use of some material other than plastics.

We recognize that the use of plastics is not the answer to every need so that when you talk to us, it's like consulting with your own molding department.

You see, when you work with Boonton, you're working with men who've been in this plastic molding business a long time, are thoroughly acquainted with all raw plastic materials used for molding . . . know what they'll do and what they won't do—successfully.

If you like this kind of help, call in Boonton men.

If it can be Molded, Boonton can Mold it—We Hope

BMCO

SPI SOCIETY OF THE PLASTICS INDUSTRY

FOR OVER 25 YEARS
CUSTOM ENGINEERS
OF MOLDED PLASTICS

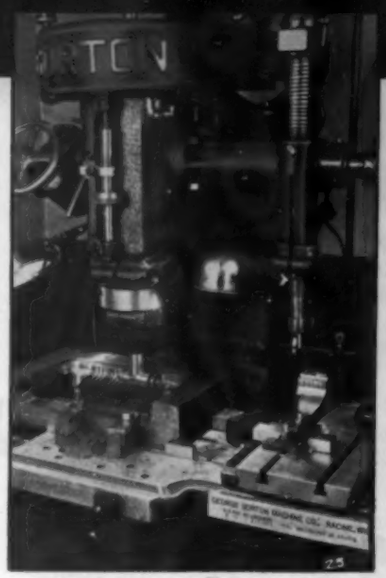
BOONTON MOLDING COMPANY

MOLDERS OF MOST PLASTICS BY MOST METHODS

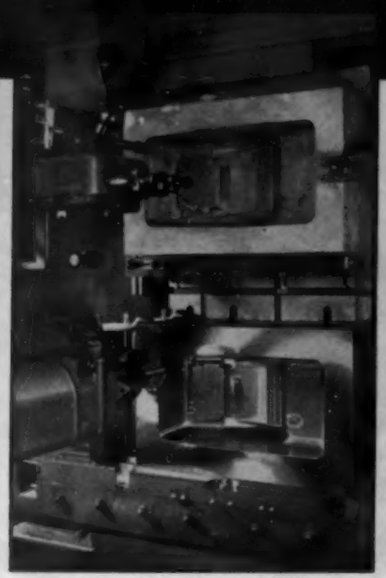
122 EAST 42nd ST., NEW YORK 17 · SUITE 1716-M MURRAY HILL 6-8540

FACTORY—BOONTON, New Jersey

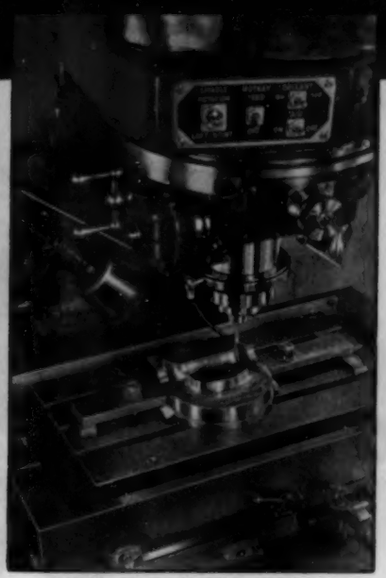
WHERE ELSE WILL YOU FIND THIS COMBINATION?



1 Cavity section for a well-known radio cabinet being cut on our Gorton Duplicator.



2 One of our Pratt and Whitney Kellers cutting a cavity for an electric adding machine cover.



3 Cherrying handle portion of circuit breaker on our Kearney & Trecker Die Miller.

"MAKE MINE KLINE"

Your shop foreman puts the stamp of approval on a Kline mold. He knows a Kline mold means clean, sharp products. That's the only way to get quick customer acceptance of a mold.

MODERN EQUIPMENT AND SKILLED MEN MEAN GOOD MOLDS

You hear a lot about "know how." Kline has it, as do a number of others. But making a good mold also demands the most modern equipment. In many shops you'll find one of the machines illustrated. A few have two, but seldom will you find a shop with all.

A plastic product is only as good as its mold — that's why some of the biggest names in plastics use Kline molds. They specify Kline when a new product is added to the line.

Plastic products must meet today's high competitive standards. A Kline mold meets ready customer acceptance.

KLINE OFFERS VALUABLE EXPERIENCE IN MODELS AND RESEARCH. WRITE US ABOUT YOUR PROBLEM.

THE KLINE MANUFACTURING CO.

GALENA, OHIO

YES!
we actually

STRETCH
paper!

The extreme light weight of our XFL saturating paper actually produces miles, not feet, per ton. Only weighs 1½ pounds per thousand square feet per point of caliper. (Example—caliper .020 weighs 30 pounds per thousand square feet.) Specifically recommended for latex saturation for the manufacture of artificial leather, etc., because of its uniformity, extreme softness and flexibility. Also recommended as a base or core stock for plastic impregnation where a sheet for post forming, scoring or punching is required.

Write for samples and prices.

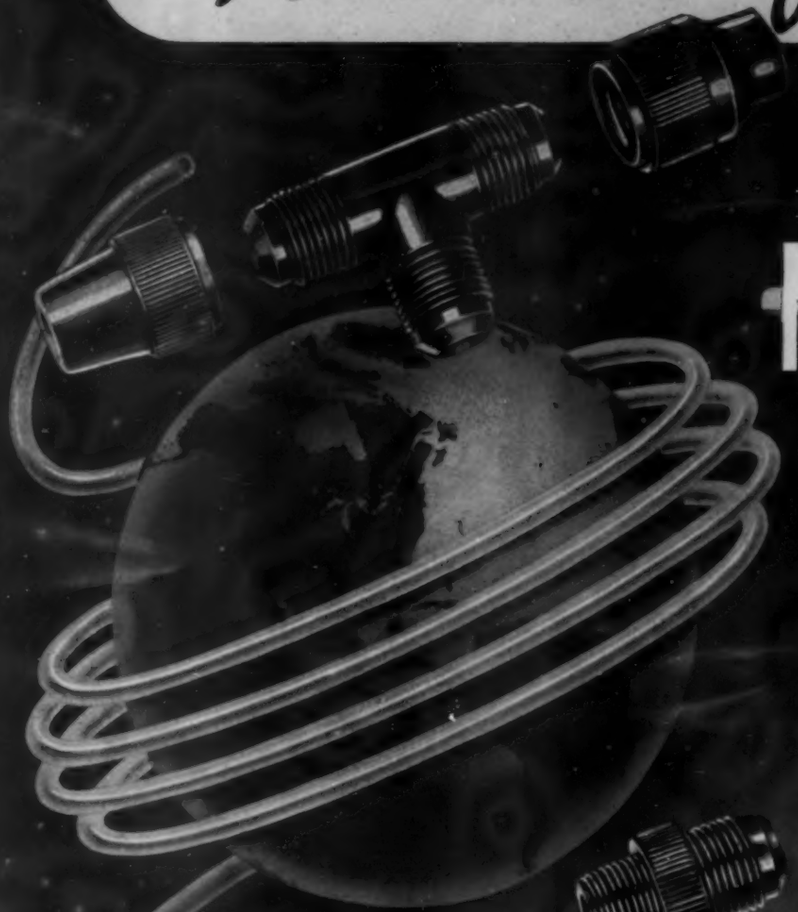
"XFL" SATURATING

Originators • Creators

HUMMEL-ROSS FIBRE CORPORATION

Hopewell, Virginia, U. S. A.

A World of Uses



MILLS PLASTIC®

Tubing Pipe and Fittings

MILLS-PLASTIC * tubing, pipe and fittings daily increase their already wide variety of applications . . . and continually contribute solutions to apparently insurmountable problems. MILLS-PLASTIC has successfully demonstrated its practical adaptability under high bursting and working pressures. Plus this, its exceptional characteristics and proved resistance to most chemicals, flexibility, insulation qualities and ease of handling . . . in many cases make it superior to the vital metals it has replaced . . .

MILLS-PLASTIC tubing is available in outside diameters of ⅛″ through ¾″ in a variety of wall thicknesses. Special sizes on request.

MILLS-PLASTIC pipe can be obtained in outside diameters of ½″ through 4″.

*Trademark Reg.

For more information about MILLS-PLASTIC tubing, pipe and fittings, write on your letterhead for our six-page circular.

ELMER E. MILLS CORPORATION

Molders of Tenite, Lumarith, Plastacele, Fibestos, Lucite, Plexiglas, Nylon, Polystyrene, Styron, Lustron, Loalin, Vinylite, Geon, Plexene, Polyethylene, Cerex, Particel, MILLS-PLASTIC*, Saran, and other Thermoplastic Materials.

153 WEST HURON STREET • CHICAGO 10, ILLINOIS

"Shaverest" cases are molded in this 4-cavity compression mold. Molding operations were facilitated by collaboration between Schick, Inc. and Plastic Manufacturers that began with the preliminary designs of the product.

PM REG. U.S. PAT. OFF.

THE Schick "Shaverest" is an excellent example of *new ideas in plastics*. Developed by Schick, Inc. and molded by Plastic Manufacturers, Inc., this remarkable shaving aid illustrates the value of close collaboration between manufacturer and molder in helping to avoid molding problems, and insuring the most practical use of plastics. If you are interested in the story of the "Shaverest," and how it was successfully produced, ask us for free reprint of an illustrated article recently published in a national magazine.

PLASTIC MANUFACTURERS

INCORPORATED

STAMFORD, CONNECTICUT

INJECTION, TRANSFER & COMPRESSION MOLDING • COMPLETE ASSEMBLY

Representatives: NEW YORK CITY—19 West 34th Street • DETROIT, MICH.—805 New Center Building
CAMBRIDGE, OHIO—633 Upland Road • LOS ANGELES, CAL.—1440 S. Robertson Blvd.
CANADA—David C. Orrock & Co., 1405 Bishop St., Montreal

"Flexol"
Trade-Mark
PLASTICIZERS

"FLEXOL" PLASTICIZERS are designed to meet industry's expanding needs for products with good general characteristics such as compatibility and low volatility. In addition, each "FLEXOL" PLASTICIZER is outstanding in producing one or more special properties such as low-temperature flexibility, resilience, or high impact strength.

"FLEXOL" PLASTICIZERS are successfully serving industry in lacquers, artificial leathers, vinyl films and sheetings, vinyl butyral safety glass, and molded and extruded products based on the vinyl resins and cellulose derivatives.

The "FLEXOL" PLASTICIZERS shown are in commercial production. Several more are available in research or development quantities. Consult us on availability.

Our laboratories have prepared extensive data on the performance of the "FLEXOL" PLASTICIZERS for many uses. This information will assist you in selecting the right "FLEXOL" PLASTICIZER or mixture of plasticizers for your needs.

COMPATIBILITY OF "FLEXOL" PLASTICIZERS (20% OF COMPOSITION) WITH VARIOUS RESINS

	DOP	3GH	3GO	4GO	TOF	B-400	8N8
Vinyl Acetate	I	C	SI	C	C	I	C
Vinyl Butyral	C-L	C	C-L	I	C	I	C
Vinyl Chloride	C	C	C	C	C	I	C
Vinyl Chloride-Acetate	C	C	C	C	C	I	C
Cellulose Acetate	I	I	I	I	SI	I	I
Cellulose Acetate-Butyrate	C	C	C	SI	SI	I	—
Cellulose Nitrate	C	C	C	C	C	C	C
Ethyl Cellulose	C	C	C	C	C	I	C
Synthetic Rubbers	C	C	C	C	C	I	C

C—Compatible
I—Incompatible
S—Slightly
L—Plasticizer sweats out

A booklet on the general function of plasticizers and the specific uses of "FLEXOL" PLASTICIZERS, Form-5882, may be of help in your application. Phone or write our nearest office for this booklet or for samples and prices.

"Flexol" is a registered trade-mark of Carbide and Carbon Chemicals Corporation.

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CARBIDE AND CARBON CHEMICALS CORPORATION

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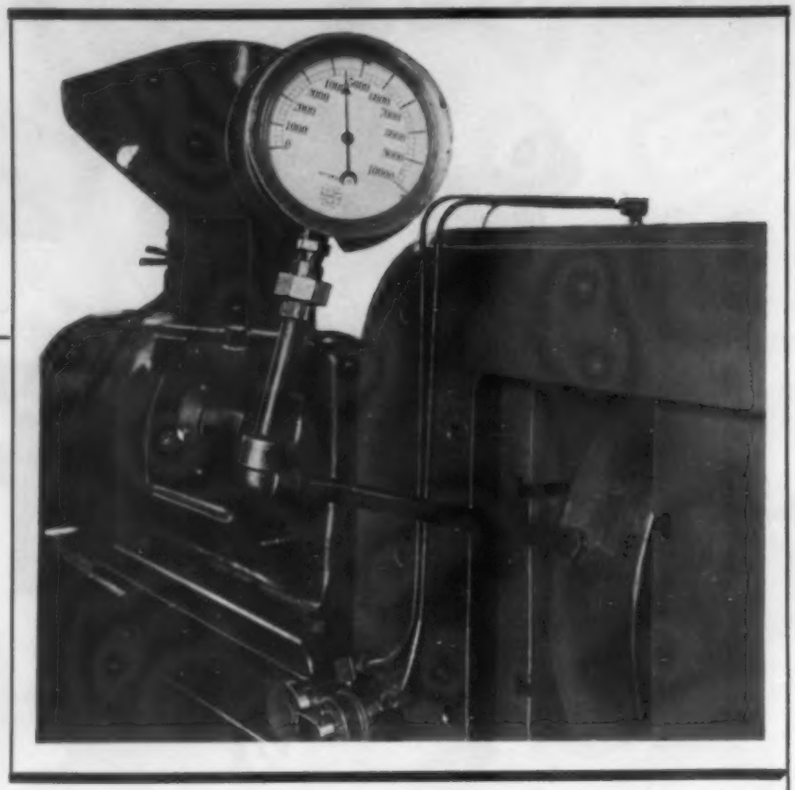
UNDER PRESSURE



Here is an unusual picture. We've run it before; we're running it again because it shows something seldom photographed: the actual clamping pressure of an injection molding machine.

This picture was taken with the press closed. A hydraulic diaphragm die was set between the die platens. Into the die was set a hydraulic gauge showing pounds of pressure per square inch. The die in the press has 200 square inches of area on a 16-inch diameter ram. A quick calculation shows that the actual die-clamping pressure of this DE MATTIA Machine is 450 tons.

This high pressure is possible because of DE MATTIA patented rolling action toggle design. DE MATTIA rolling action patented toggles are made of hardened steel slabs with no pins or parts to wear out. They are responsible for the unusual pressures which DE MATTIA presses build up.

It's the exclusive DE MATTIA features that make DE MATTIA machines known throughout the injection molding field for top performance.

Exclusive De MATTIA *Features*

1. Actual die-clamping pressure over 400 tons.
2. Complete injection time two seconds.
3. Solid plate frame.
4. Plasticizing capacity: over 130 lbs. per hour
5. Patented rolling action toggles non-wearing.
6. One piece welded steel base.
7. Injection pressures controlled to 30,000 lbs.
8. Hydraulic adjustment for die changes.
9. Valves, fittings, etc., mounted outside for accessibility.
10. Compact, saves space—only 38 in. by 12 ft.
11. Net weight 16,000 lbs. approximately.

* Above specifications refer to 12-ounce machine

DE MATTIA *Machine and Tool Co.*

CLIFTON, NEW JERSEY

New York Office — 50 Church Street
Cable Address: BROMACH, N. Y.

Chromy says:

"Put the Heat where you want it!"

Chromalox
Electric Immersion Heaters

for temporary or permanent installations

Sizes 1 KW to 36 KW, automatic or manual temperature controls.

Available in many types with metal sheaths to resist corrosive action of liquids being processed.

Drawing illustrates Immersion Unit equipped with sludge-legs and installed over side of tank for direct heating.

Fast · Economical · Easy to Install

Heat is right where it's needed when you equip your plant with CHROMALOX Immersion Heaters. Versatile in application—they are used as portable or permanent heat-sources in tanks, vats and other containers.

With CHROMALOX *Electric* Immersion Heaters, you can accurately heat and maintain the temperature of degreasing, cleaning, pickling and plating baths. You can melt greases, asphalts and similar viscous fluids. In fact, you can put CHROMALOX Immersion Heaters to work in almost any fluid-heating job in your plant.

Get in touch with your CHROMALOX Application Engineer. He'll gladly recommend the right equipment to give you clean, dependable, trouble-free electric heat.

CHROMALOX
Electric Heat for Modern Industry

Guide to CHROMALOX *Electric Heat* applications

Check this list

- Glue Pots
- Ink Dryers
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- Tempering Baths
- Heating Molds
- Soldering Irons
- Steam Boilers
- Tinning Pots
- Heat Sealers
- Oven Heaters
- Coating Tanks
- Hot Salt Baths
- Lacquer Dryers
- Space Heaters
- Baking Ovens
- Branding
- Die Heaters
- Hot Plates
- Pitch Pots
- Glue Cookers
- Driers
- Heating Castings
- Drying Ovens
- Process Kettles
- Preheating Fuel Oils
- Annealing Ovens
- Package Sealers
- Armature Heaters
- Roll Heaters
- Sterilizers
- Print Drying
- Distilling
- Radiant Heating
- Glue Setting
- Dehydrating
- Process Air Heating
- Dropping Resistors
- Humidity Control
- Heating Drums
- Tire Recapping
- Soaking Tanks
- Platen Heaters
- Embossing Dies
- Oil Baths
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- Hair Dryers
- Vulcanizing
- Asphalt Melting
- Steam Generators
- Can Soldering
- Steam Superheaters
- Mold Heaters
- Babbitt Melting
- Duct Heaters
- Electroplating
- Room Heaters
- Varnish Drying
- Soil Sterilizing
- Wax Melting
- Heating Pipes
- Water Heaters
- Heating Volatile Fluids
- Heating Gases
- Galvanizing
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- Core Baking
- Labeling Adhesives
- Prevent Freezing
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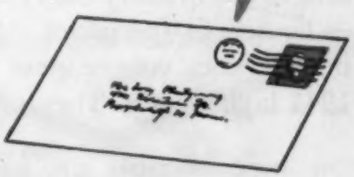
And Hundreds of Other Applications Throughout Industry.

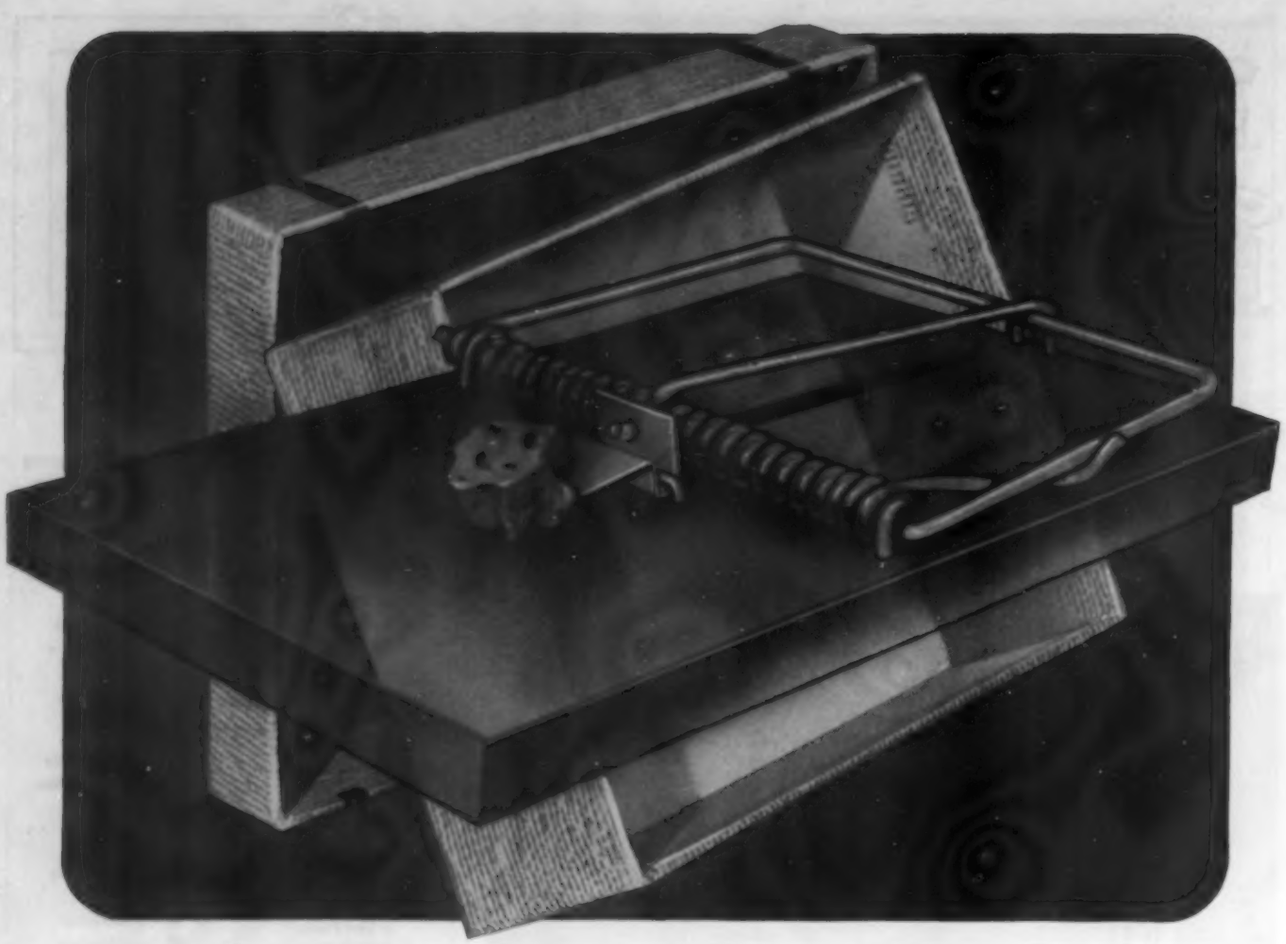


FOR MORE INFORMATION...

Write for "100 Ways to Apply Electric Heat" booklet, Catalog 42, and address of Chromalox Application Engineer serving you.

IC-20

EDWIN L. WIEGAND COMPANY, 7503 THOMAS BOULEVARD, PITTSBURGH 8, PA.



☆ARE *You* BUILDING A BETTER MOUSETRAP?

IF so, people may be beating a path to your door - - - but, if you are not making mousetraps, you may be manufacturing some of the other billion and a half dollars* worth of household specialties made in this country each year. Then, you probably rely for sales appeal on some of the 171 million set-up boxes sold to this industry each year. This big business — household specialties — expects an increase in unit sales volume next year of 14% over 1943 high figures. They say they prefer set-up boxes two to one over other containers because:

1. *A set-up box is custom-built to the product.*
2. *A set-up box has greater strength.*
3. *A set-up box sells easier on sight.*
4. *A set-up box gives better product identification.*
5. *A set-up box has added "take home" appeal.*
6. *A set-up box has smart style value.*

*Write to the National Paper Box Manufacturers Association for survey No. 91, "Household Specialties Industry", compiled by the Postwar Planning Committee.

FOR INFORMATION OR SERVICE • CONSULT YOUR NEAREST SET-UP BOX MANUFACTURER

NATIONAL PAPER BOX MANUFACTURERS *Association*

AND COOPERATING SUPPLIERS

Liberty Trust Building • Philadelphia 7, Penn.

Read why

INDUSTRY'S Fastening-wise LEADERS CHOOSE PHILLIPS SCREWS

INDEPENDENT STUDIES! AUTHENTIC! UNBIASED! Prepared by investigators from the James O. Peck Co., industrial research authorities, who talked with key men in top U. S. plants using Phillips Recessed Head Screws in product assembly.

"Assembly savings 50%" . . . "Breakage reduced 90%" . . . "Eliminate $40.-a-day spoilage." In their own words, America's best assembly men tell how they apply the proved advantages of Phillips Screws to speed driving, end driver skids, eliminate unsightly burrs, improve product appearance.

Each report is fully illustrated – a fact-jammed digest of modern assembly practice, information you never hoped to see in print, inside facts you would pay good money to get – now, FREE, to you.

12 Reports Now Ready

These reports have been offered as they were published throughout the year. If you haven't already sent for them, get all twelve now. Read them! Learn why, more and more, Phillips Screws spot the profit-planned products!

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Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

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Send me the 12 Assembly Reports on Phillips Screws.

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here are ways that BALDWIN can help you

FIELD APPLICATION SERVICE

When you're thinking about the jobs you want presses to do . . . your production men may get some helpful tips from a Baldwin engineer. Long contact with the field, plus Baldwin participation in research projects, equip these representatives to discuss your problems from *your* viewpoint, and cooperate in finding the exact answer to your individual need.

STANDARD PRESS LINE WITH "CUSTOM-BUILT" FEATURES

When you're thinking about the presses for the jobs you want done . . . you'll find a line of modern Baldwin presses waiting to serve you. These presses include many of the "custom-built" features, developed through years of individual press design, that you ordinarily find only in special units. They are made available on standard models through efficient production methods in the Baldwin shops.

DESIGNS BASED ON LONG EXPERIENCE

Baldwin press designs are based on the accumulated experience of half a century devoted to designing and building hydraulic machinery. They reflect the engineering skill gained in meeting many problems in this field. We will welcome an opportunity to work with you. The Baldwin Locomotive Works, Philadelphia 42, Pa., U. S. A. Offices: Philadelphia, Chicago, St. Louis, Washington, New York, Boston, San Francisco, Birmingham, Houston, Cleveland, Detroit, Pittsburgh, Norfolk, Seattle.

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BALDWIN

HYDRAULIC PRESSES

Speed Nuts*

Give You More Assembly Advantages

Than Any Other Nuts, Regardless of Price

PREVENT VIBRATION LOOSENING

SPEED NUTS prevent vibration loosening because they provide a *double* spring-tension lock that *absorbs* vibration instead of merely *resisting* it. Insures a tight attachment for the life of the product.

SPRING TENSION RESILIENCY

In the assembly of porcelain enamel, plastic or glass parts, SPEED NUTS provide the tension necessary for a tight assembly, yet are sufficiently resilient to prevent damage due to expansion and contraction, vibration or shock.

APPLIED FASTER

SPEED NUTS put wings on your assembly lines because they start easier, pull down faster and no wrench is required to keep them from turning. Made also for use with coarse-thread sheet metal screws, requiring fewer turns to tighten, for still faster application.

ELIMINATE LOCK WASHERS

You can boot lock washers out the window, for SPEED NUTS are self-locking. They cut both material and handling costs. Because of their wide bearing surface, SPEED NUTS also can eliminate the use of spanner washers.

SELF-RETAINING

Many types of SPEED NUTS lock themselves in screw-receiving position for "blind" location assembly, eliminating expensive welding, riveting or clinching operations.

PERFORM MULTIPLE FUNCTIONS

Like a one man band, many special types of SPEED NUTS perform multiple functions, replacing two or more parts. SPEED NUT prongs can be incorporated in almost any shape or form to do the job easier and faster.

LOCK ON UNTHREADED STUDS

"Push-On" SPEED NUTS need only be pushed over rivets, nails, tubing, or unthreaded studs to lock parts so securely, you can't wrestle them off. Costly threaded inserts, drilling and tapping are eliminated—molding costs reduced—assembly speeded up.

WILL NOT CLOG

Having no threads, SPEED NUTS cannot clog with paint. No assembly delay for re-tapping threads. This is particularly important where SPEED NUTS are permanently attached to parts for blind assembly.

WILL NOT "FREEZE" TO THREADS

Having no threads, SPEED NUTS will not "freeze" to rusting bolts. They can be easily removed at any time for servicing or replacing. You'll save the repair men a lot of cussing.

WEIGH LESS

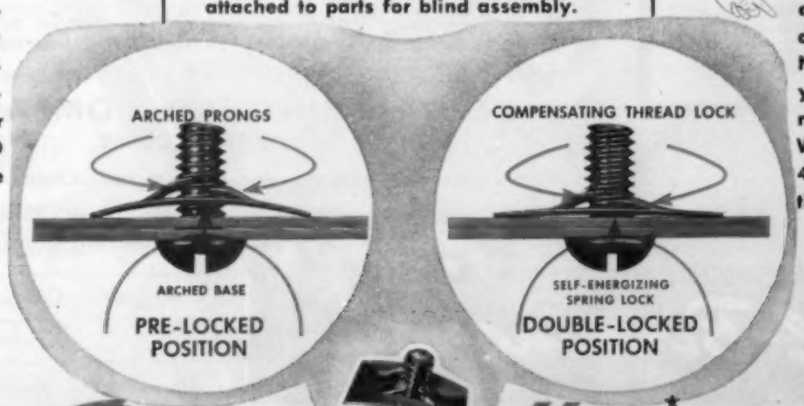
Because they are made of sheet metal instead of bar stock, SPEED NUTS are in the "featherweight" class compared with threaded nuts. By eliminating lock and spanner washers and other unnecessary parts, weight is reduced still further.

MINIMIZE SHIPPING DAMAGE

SPEED NUTS give you free insurance against shipping damage. They provide a resilient lock that defies loosening and prevents cracking of enamel and glass. With SPEED NUTS, your products will reach your customers in perfect condition.

SEND TODAY

We're not fooling about these advantages. They are very real and worth-while as any SPEED NUT user will tell you. Rush your assembly problems to us now, giving complete details. We'll show you which of the 4000 shapes and sizes will do the trick for you.



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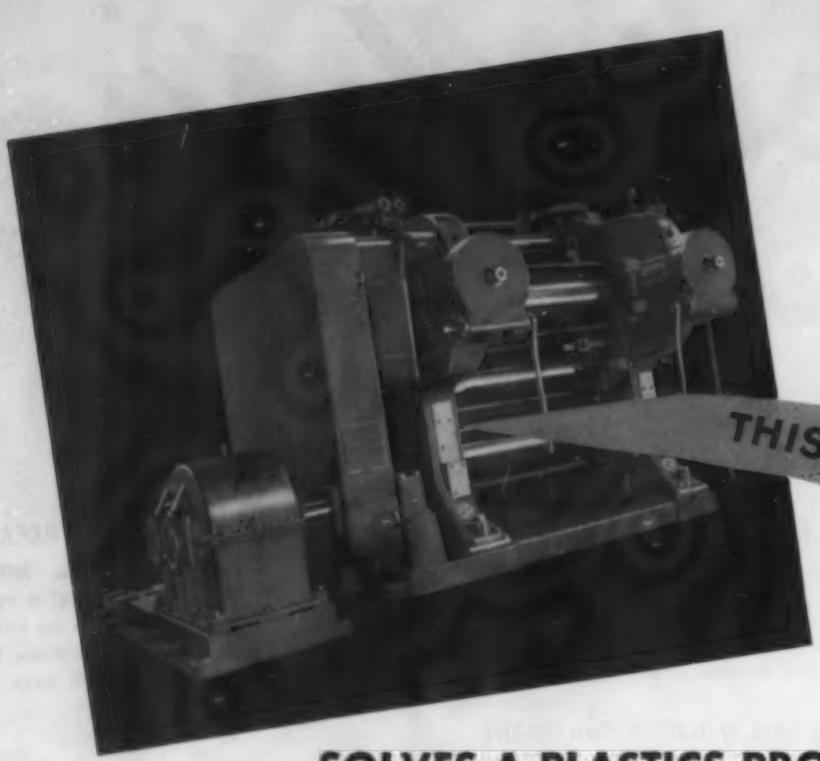
FASTEST THING IN FASTENINGS . . . MORE THAN 4000 SHAPES AND SIZES



THIS (F/B) CALENDER

SOLVES A PLASTICS PROCESSING PROBLEM

Designed for the highly specialized work of calendering plastics—a continuous, high-speed operation that demands the most rigid gauge control for satisfactory production—this 24" x 66" four-roll calender is another example of Farrel-Birmingham's ability to engineer answers to plastics processing problems.

A look at the major features of the unit shows how thoroughly skilled design and careful construction cope with the hazards of a difficult manufacturing process to keep it on a profitable basis.

GAUGE CONTROL—To maintain close control of gauge while the calender is in operation, top and bottom rolls are adjusted by a special motor and high ratio reduction unit. Minute movement of either roll end is controlled by push button. Side roll adjustment is by individual ratchet through worm and worm gear.

ROLLS—The rolls are hard chilled iron, cast under close metallurgical control, and ground with extreme accuracy. The rolls are carried in water-cooled journal boxes, which are full bronze-lined and fixed-lubricated.

ROLL HEATING—Each roll is chamber-bored to assure exact wall thickness, and is fitted with rotary joint and interior distributing pipe for uniform heating.

GEARS AND DRIVE — The steel drive and connecting gears are precision generated with continuous herringbone teeth. They are enclosed in sheet steel guards and run in oil bath. Right angle reduction unit requires minimum floor space.

HOUSINGS AND BEDPLATE — Box section Meehanite castings of ample proportions assure necessary strength and rigidity. Provision is made for future addition of cooling rolls and wind-up.

Farrel-Birmingham will design and build a plastics processing unit to fit your specific application. Write today for information and engineering help. FB-333

F-B PRODUCTION UNITS

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- Plasticators
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- Bale Cutters
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- Crackers
- Washers
- Calenders
- Hose Machines
- Hydraulic Presses and other equipment for processing rubber and plastic materials.

FARREL-BIRMINGHAM COMPANY, INC.
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Farrel-Birmingham

RESINOX

hits the mark again!

Eject-O-Matic Soldering Iron by Multi-Products Tool Company, Newark, New Jersey.

In this new, efficient, pistol-type soldering iron, Resinox proves again its outstanding qualities of rugged durability, excellent electrical properties, high heat resistance and molding adaptability.

Resinox, Monsanto's versatile thermosetting phenolic plastic, has been long and favorably known for many functional and decorative applications. New formulations, new molding skills and new equipment are continually adding to this wide range of profitable Resinox uses. It will pay you to check your manufacturing requirements against this list of Resinox qualities:

1. Low cost
2. Molding adaptability
3. Inherent color and finish
4. Exceptional electrical insulating properties
5. High heat resistance
6. Permanent strength
7. Excellent resistance to chemicals, water and aging
8. No costly finishing or coating operations necessary

For full details on Resinox . . . or for the answer to any kind of plastics question . . . address MONSANTO CHEMICAL COMPANY, Plastics Division, Springfield 2, Massachusetts. In Canada, Monsanto Ltd., Montreal, Toronto, Vancouver. Resinox: Reg. U. S. Pat. Off.

MONSANTO
PLASTICS
SERVING INDUSTRY . . . WHICH SERVES MANKIND

Measured in COLD CASH... HERE'S HOW

AMERICAN PHILLIPS SCREWS

Pay Off to Refrigerator-Makers...

and to Refrigerator-Users, too

TO MANUFACTURERS: American Phillips Screws pay off in many ways, whether you build refrigerators or miniature trains. They speed up handling, increase worker-proficiency by building confidence, cut down losses from dropped screws, "drunken driving," scarred work-surfaces, spoiled material, and lost time from self-inflicted wounds. All because American Phillips Screws make power driving safe, easy, non-fatiguing . . . *and automatically straight.* Now total up the pay-off . . . and you'll find TOTAL TIME-SAVINGS RUN AS HIGH AS 50%.

TO CUSTOMERS: American Phillips Screws add the merchandising lure of handsome, modern, workmanlike appearance, inside and out . . . a look of quality that helps to make the prospect say: "That's for me!" This modern, cost-cutting method of fastening is actually *sales-promotion plus sales-protection.* Are *you* in on this payoff? Write American for recommendation of the type and metal of American Phillips Screws which will do the best job at lowest cost.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois St. *Detroit 2:* 502 Stephenson Building

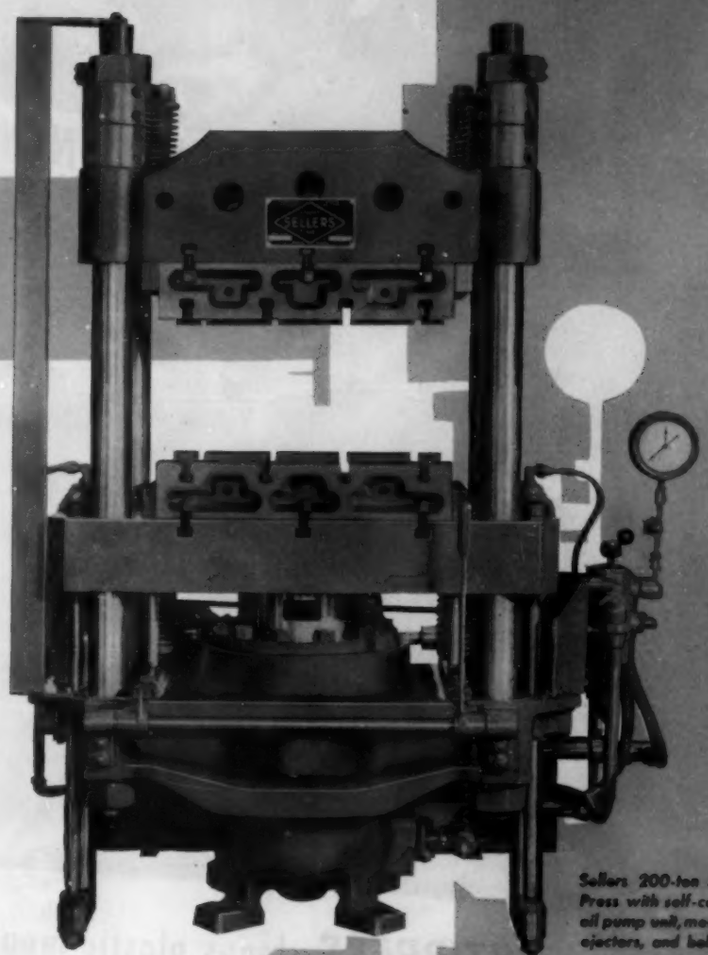
AMERICAN PHILLIPS *Screws*

ALL TYPES

ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

SELLERS COMPRESSION MOLDING PRESSES:—
Self-contained or for Accumulator Operation—manual, semi-automatic or fully automatic control—capacities from 50 to 1000 tons or larger, if desired —mechanical or hydraulic ejectors— top and bottom bolsters—parallels
TOP CYLINDERS CAN BE FURNISHED FOR MODERN TYPE TRANSFER MOLDING

A SELLERS HYDRAULIC PRESS For Modern Plastic Molding



Sellers 200-ton Molding Press with self-contained oil pump unit, mechanical ejectors, and bolsters.

Sellers Hydraulic Presses are designed to meet the most exacting requirements in the field of plastic molding. We can bring to you more than 20 years contact in the plastic molding field, covering all types of compression and transfer molding. Let us work with you so that you have the most efficient and speedy type equipment for your work.

FOUNDED SELLERS 1848

WILLIAM SELLERS and Company, Inc.

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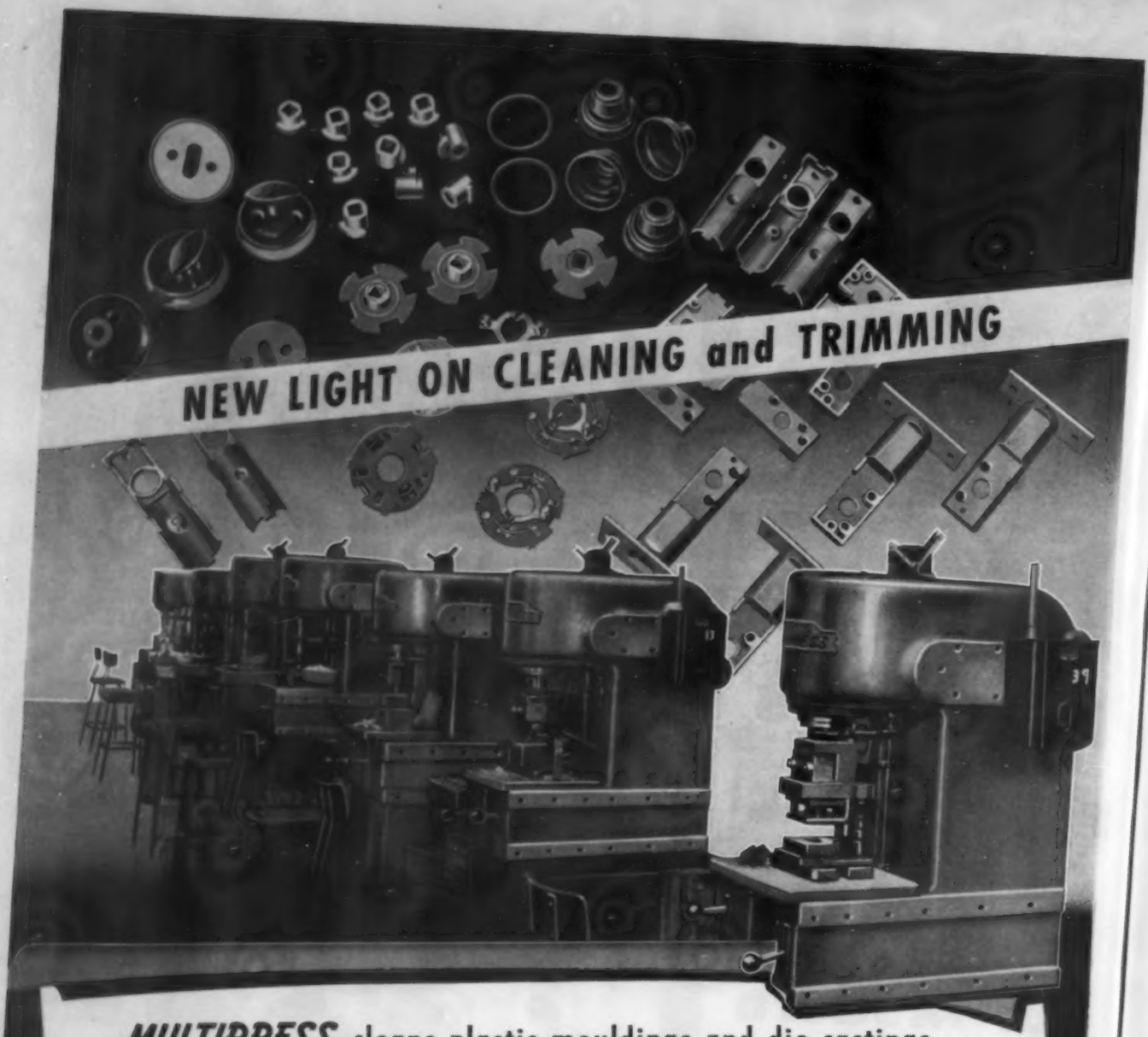
1600 HAMILTON STREET PHILADELPHIA 30, PA.



MULTIPRESS cleans plastic mouldings and die-castings

PROOF that MULTIPRESS does a quick, clean, accurate job of trimming both plastic mouldings and metal die castings is found in results obtained from the eight-unit MULTIPRESS line-up shown above.

These MULTIPRESSES at the Los Angeles plant of the Pacific Plastic and Manufacturing Co., Inc., *average* 7000 trimmed parts per day —about one every four seconds!

MULTIPRESS pressures can be preset at the exact level required for each job *without use of excess tonnage*. This reduces tool wear and prevents damage to either the press or the tooling if unusually heavy metal is encountered.

Operators also report that closely regulated pressures *plus* the controlled speed of the MULTIPRESS ram reduces distortion or fracture of off-dimension parts.

Another MULTIPRESS advantage is that its working stroke can readily be adjusted to parts of various sizes. This cuts costs in switching from one trimming operation to another.

MULTIPRESS is built in 4, 6, and 8-ton capacities, offering seven models in each size with either manual or automatic controls. A wide variety of *standard* MULTIPRESS toolings and accessories are available for many different types of operations. Write for complete details!

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MODERN PLASTICS

VOLUME 24 JANUARY 1947 NUMBER 5

Plastics for 1947

A review of the plastics situation in 1946 and a forecast of what is ahead in the coming year

LIKE nearly all other industries, plastics is suffering from complications brought on by the combination of a seemingly unquenchable demand from customers and an expanding processing plant which material suppliers have not been able to satisfy due to difficulty in securing chemicals and manufacturing facilities.

It is the opinion of MODERN PLASTICS, based on surveys of the industry, that there will be a considerable leveling off of inequalities during 1947, provided the national economy acquires some semblance of stability. No one, however, expects all the peaks and valleys to level off in 1947—there are too many of them.

Many experts assert that the only hope for supply to catch up with demand would be a serious slump in the latter. And if that should come it would create another type of problem which the plastics industry has never had to face on such a large scale—the problem of selling new concepts and new ideas in competition with long established materials that would be plentiful and low in cost. Yet one prominent sales manager in the industry has pronounced it as his opinion that plastics would really come into their own during a depression, their sales appeal and quality winning public acceptance for end use products over other non-plastic materials.

This article is no harbinger of evil days ahead. If they come every one will have to readjust their sights and make adjustments. However, in view of the pent-up world demand for almost everything, it seems unlikely that a slump could last for long although it could have a temporary paralyzing effect emphasized by an unbalanced supply line.

Take as a hypothetical example, automobile steering wheels. Many prognosticators figured that passenger car production would be in excess of 3,500,000 in 1946. Although 286,000 cars came off assembly lines in October, it is doubtful that total production for the year was over 2,100,000. Therefore, if wheels were made for 3,500,000 cars, there would be 1,400,000 left in inventory. If the auto industry should plan for 4,500,000 cars in 1947, plastics estimators for steering wheels might overlook the 1,400,000 wheels in inventory and plan to build for a market already over 1/4 supplied.

This, of course, is not likely to happen in such an obvious field as steering wheels but, as a hypothetical example, the sequence points out what is actually happening in more complex fields and illustrates the difficulties involved in any attempt to evaluate the 1947 market. The example also helps to explain the reason for this nations' gigantic $32,000,000,000 inventory figure. The largest on record, this inventory is not as dangerous as it looks according to many economists who claim it

CONTENTS OF FORECAST AND REVIEW

Molders want this material*

Company A: Wants 30,000 lb. thermosetting molding powder per week for a 6 lb. radio cabinet.

Company B: Used 5,000,000 lb. thermosetting and 800,000 lb. thermoplastic in 1946. Wants to double 1946 on commitments already made. One job of dishware will take 500,000 lb. of urea a month; another, 100,000 lb. of polystyrene a month.

Company C: Required for 1947 are 1,000,000 lb. of thermoplastic material for refrigerator parts; 500,000 lb. (about 80 percent thermoplastic) for automotive parts; 800,000 lb. of thermosetting material for radio cabinets; 1,050,000 lb. of thermoplastic material for toys and household items and 400,000 lb. for furniture.

Company D: Requires 750,000 lb. of melamine and 200,000 lb. phenolic for grilles; 450,000 lb. melamine and 600,000 lb. of phenolic for bottle warmers; 1,400,000 lb. of thermosetting material for electrical appliances and radio cabinets.

Company E: Needs 133,000 lb. of polystyrene monthly for lighting appliances; 60,000 lb. of acetate monthly for musical instruments.

Company F: Will use 75,000 lb. of polystyrene and 25,000 lb. of acetate a month in 1947 for bathroom fixtures and household hardware.

Company G: A loudspeaker housing, requiring 10 lb. per unit, will need 100,000 lb. of thermosetting per year; another large housing will require 200,000 lb. of thermosetting per year; various small items like iron handles now running 300,000 lb. of thermosetting material a year.

Company H: Wants 15,000 lb. of phenolic a month for molded gun stock: an electrical appliance takes 18,500 lb. of phenolic monthly; utensil handle takes 20,000 lb. phenolic per month; 12,000 lb. of urea and 2000 lb. of phenolic per month for wall brackets; 48,000 lb. of styrene and acetate per month for a camera, syringe, clothespin, pistol grip and toothbrush package.

Company I: Needs 1,464,000 lb. of phenolic a year for lightning arrestor base on telephone equipment, a cabinet, inter-office communication housing, condenser housing and various other jobs. Also needs 10,000 lb. of acetate a month.

Company J: Needs 2,000,000 lb. of urea per year for electrical appliances and lighting fixtures; 725,000 lb. of urea for clock and scale housing.

Company K: Will use 10,000 lb. of acrylic and 60,000 lb. of styrene per month on auto job.

* This listing of material requirements of companies, picked at random, indicates the amount the firms will need to process jobs for which they have already made commitments.

is largely made up of component parts waiting to go into such things as automobiles, refrigerators, furnishings for which there is a present insatiable demand.

Plastics linked with other industries

The plastics industry expanded beyond belief in 1946 over 1945—it had to in order to keep up with the unprecedented demand made upon it. Note these figures: The national durable goods production in October was running at 214 percent of the 1935–1939 average or 25 percent above the first half of 1946.

All time peaks were reached by radios, gas ranges, electrical ranges, washing machines and vacuum cleaners. Only mechanical refrigerators, automobiles and sewing machines failed to exceed prewar rates. Plastics demand is definitely linked to those products. This is further evidenced by reports on prospective material needs in 1947 sent in by representative molders who gave examples of jobs already on hand and the amount of plastics that would be needed. A partial listing of these needs is presented in the next column. No wonder then that molders, laminators and extruders have been crying for more material with which to meet the steadily increasing need of their customers.

Letters from molders in reply to MODERN PLASTICS' survey indicate that some cancellations have been received, but on a comparatively small scale. One molder pointed out that buying has become more selective but that there is no lack of customers for well-designed products. Some plastics suppliers to the automotive and refrigerator industries report that they have received postponed delivery requests due to the inability of their customers to obtain component parts.

More disturbing are reports from proprietary molders —from the one, for example, who has discontinued a stock mold item using 200,000 lb. of phenolic molding powder per month and turned down a contract on another item requiring 200,000 lb. a month due to his inability to obtain material. Several in this group reported that they were making no effort to find new customers because they couldn't satisfy their old ones.

Volume limited by material shortages

The mail survey indicated that molders and extruders were sorely disappointed in the amount of material they received in 1946. Of those replying, 45 percent reported that they received about 70 percent of the amount asked for, 27 percent received between $1/2$ and $3/4$ of what they requested and 24 percent said that they received less than $1/2$ of the desired amount. Many pointed out that they were told how much material they could have before they placed their orders. As a result, in quite a few instances the shortages reported on the survey do not show the actual shortage.

When asked how much more business they could have done on a dollar basis in 1946 if all desired material had been obtainable, molders replied as follows: 10% could have done 100% more dollar volume; 30% could have done 50 to 100% more volume; 31% could have done 10 to 50% more volume. The greatest number of

PHOTO, COURTESY MARSHALL WHITE CO.

PHOTO, COURTESY DUREZ PLASTICS & CHEMICALS, INC.

(Left) Large moldings like this urea silverware chest account in part for the heavy demand for plastics. (Right) The industrial field is a heavy user of all types of plastics. Here, housing of a soldering iron is molded of phenolic

those reporting estimated possible business lost through lack of material as 25 percent. A good portion claimed only 5 percent, many refused to estimate.

Dollar volume in 1947

There isn't much question but that molders are expecting a greatly expanded business in 1947. Answers to this magazine's query as to how much business they expected to handle in 1947 in comparison to 1946 grouped themselves as follows:

Percentage of molders	*Increase expected in 1947*
5	100 to 300% increase
10	100% increase
3	75 to 99% increase
23	50 to 74% increase
26	20 to 30% increase
9	10% or less increase

Some 20 percent refused to hazard an estimate, largely due to uncertainty of obtaining raw material. About 4 percent estimated in astronomical figures not shown here. According to the above tabulation the mean average is in the group that expects a 50 to 75 percent increase in business. However, after carefully checking the returns, the editors of this magazine believe that most of the old established firms in the industry who are, at present, using the most molding and extrusion material are in the group which expects to increase business by from 20 to 30 percent.

From these estimates we gather then that about 25 percent of the industry is expecting to use around 25 percent more material than the total production for 1946. The 41 percent of the molding industry (represented largely by smaller volume companies) who want to increase more than 50 percent, plus that portion of the 24 percent not included in the above table who also want to increase their production over 50 percent, would probably not use much more molding material than the high volume users who expect only a 25 or 30 percent increase. From these factors it is possible to deduce that if raw material production is increased by 50 percent in 1947 it may come near filling demand by the end of 1947.

What are the chances of meeting this increased demand? At present they look fairly good—in fact a 50 percent increase in 1947 would be about the same percentage of increase that raw materials suppliers provided in 1946 over 1945. A glance at the charts on pages 104, 105, 106 and 107 and the addition of poundage to include ethyl cellulose, acrylics, polyethylene, nylon, casein and miscellaneous powders show that production rose from 230,000,000 lb. in 1945 to 334,000,000 lb. in 1946. Our estimate for production of molding materials of all types in 1947 is given in Table I (below).

If suppliers produce as much material in 1947 as is indicated in Table I it will be a 58 percent increase over 1946 and should go a long way toward supplying processors with a major portion of the processors' needs. The big factor in this increase will be polystyrene and it would seem that this of all the plastics listed in Table I is the most likely to reach its goal.

Of course, molders and extruders may not always be able to get the particular material they want. They have, however, become accustomed to switching from one to another and that should be no great hardship.

To keep pace with the demand for their product, molders and extruders are expanding their facilities at a fast pace. According to MODERN PLASTICS' survey more than 28 percent increased their capacity to pro-

Table I.—Estimated Molding Powder Production in 1946 and 1947—Exclusive of Vinyl

Material	*1946*	*1947*
	lb.	*lb.*
Phenolic	140,000,000	170,000,000
Urea	35,000,000	60,000,000
Acetate and butyrate	84,000,000	105,000,000
Polystyrene	55,000,000	150,000,000
Miscellaneous	20,000,000	35,000,000
Total	334,000,000	520,000,000

The S.P.I. looks to the future

by Neil O. Broderson*

THERE is no sure way for anyone to make an accurate chart of the industry's future, principally because of bottlenecks which followed cessation of hostilities and the uncertainty of the immediate future. But it is easy to see beyond those bottlenecks into range of probabilities.

NEIL O. BRODERSON

In recent days I have talked with several materials producers who know of applications so vast that if they were activated today it would tax the materials producing capacity of the industry. Whereas we were talking a year ago of *possible future tonnages* of the plastics industry, today these tonnages are certain after we have broadened bottlenecks by settling labor disputes and adjusting abnormal factors affecting us.

With our industry's growth we have seen The Society of the Plastics Industry, Inc., broadening its postwar work. Not only are all the excellent technical services continuing, but we have added an entirely new division which will serve the interests of the film and foil branch of the industry. Committees dealing with the fields of public relations, education and informative labeling are activating more intensive programs, essential under peacetime conditions. These committees will be augmented as need arises. A definite liaison between them is being developed.

Figures from S.P.I.'s statistical department show a rise in the total of all molded sales since late 1945. The distribution of these sales by geographical areas is interesting. We find that in the West plastics molding sales represent about 10 percent, in the Midwest approximately 25 percent, and in the East 65 percent.

Dollar volume sales have risen in all types of molding this year. Thermosetting molding, which took a natural drop after cessation of hostilities in the Pacific, has regained so rapidly that its dollar volume sales are now only about 30 percent below record attained in early 1945 when war demands were at a peak. Thermoplastics molding is now surpassing its mid-1945 peak.

These statistics represent a tribute to the skill and technological progress in the industry under wartime conditions, which have carried us over into peacetime production. But, more importantly, they represent a tribute to the sound judgment of the plastics industry in its determination to continue its expansion on into the peacetime period.

* President of S.P.I. and president of Rochester Button Co.

duce in 1946 by 100 percent over 1945 while 12 percent increased their capacity more than 1/2 over 1945. Only 10 percent reported no increase. An overall production capacity increase of 50 percent on the part of molders is certainly a conservative estimate. The type of expansion is of considerable interest.

Type of expansion in 1946

47 percent added compression presses
54 percent added injection presses
10 percent added extrusion presses
40 percent added other equipment
63 percent added floor space. Of this number, 44 percent added about half again as much space as they had before.

An average of 12 weeks for a mold

On the special matter of obtaining molds, operators say that from 2 to 16 weeks are now required to procure them. The mean average was 12 weeks. Apparently this angle of the business is very spotty. After all, 12 weeks is not far from the average in normal times. Quick service can frequently be obtained if a molder is willing to trust some of the new and younger mold makers who have recently started in business. Contributing to the slowness in delivery is the fact that competent labor for such precision work is not much easier to find now than during the war.

Switching from one plastic to another

Of those who answered the question on whether or not they had switched from one plastic material to another for various jobs, 44 percent said "yes." Of that 44 percent more than half said the switch was permanent. In this connection it would be wise for the reader to remember that those comments came from molders rather than from customers.

Most of the switches were undoubtedly made because of a processor's inability to obtain a certain material and the comparative abundance of another. Whether or not they will be permanent depends upon many things that may happen in the next few years.

While on the subject of switching materials it is interesting to note that in answering the question on which materials seemed most difficult to obtain, molders put the two old standbys, phenolic and acetate, at the

top of the list. It will perhaps surprise some of the doubters, who questioned the possible postwar growth of urea to sizable quantities, to see how strong demand is running for this material. Asked to name the most difficult material to obtain, most molders named two or three plastics, the results falling as listed below:

Raw materials which seemed most difficult to obtain

45 percent answered phenolic
40 percent answered acetate
39 percent answered urea
28 percent answered polystyrene
23 percent answered butyrate
14 percent answered vinyl
10 percent answered acrylic
10 percent answered miscellaneous

Much could probably be deduced from these answers but we will let the reader form his own conclusions with the one observation that it seems as though the compression molders are having a bit more trouble than are injection molders in obtaining materials.

Aside from the material situation, molders have other weighty problems confronting them. It is evident from their letters and their conversation that although they are extremely optimistic about the volume of business available for 1947 they are privately concerned about the mushroom growth of their industry in the last two years. Several commented in their report that the industry was threatened with overexpansion by the advent of adventurers and others who were attempting to break into the industry without knowledge or ability. Many in this group are turning out low-grade products that react on the entire industry.

No one has as yet suggested a method for combating this trend. It will probably take a depression to shake them out. Such a catastrophe may also eliminate many of those who complain about the invader, themselves having sometimes been guilty of marketing items that never should have been made of plastics.

It is no secret that some of those who rail against the supplier for failure to provide enough material are using the plastics they get for items that can only be considered as temporary—that will never stand up in competition with other materials. Who is to blame a supplier if in time of scarcity he channels his material to molders who are assured of a future market?

Another problem confronting custom molders is the spread of molding operations into firms who may choose to make their own parts in the future. The average molder is quite brave about it. He insists that such firms will give up when they find that the molding of plastics is a specialized industrial art and will return to the custom molder. Nevertheless it seems that there is scarcely an important custom molder who is not attempting to set up a few proprietary items to offset a possible loss in business to consumer molders.

Machine capacity on the upgrade

LIKE most other industries today, plastics is afflicted with an economic disease that is apparently a phenomena of the postwar period. That disease is a lack of balance between raw material and processing equipment. In other words, there is far more machine capacity for the conversion of plastic raw materials into finished products than there is capacity to produce raw materials. The rate of growth in the number of processing machines in the industry as indicated by the figures in Table II is far greater than the rate of increase in raw materials.

As pointed out by Mr. W. Stuart Landes, president of P.M.M.A. and vice-president of Celanese Corporation of America, in MODERN PLASTICS in May 1946,[1] the number of injection machines has tripled since 1941 and the average size of the machines in service has increased from 6 to 10 ounces.

The number of extruders has increased in even greater proportion. In fact there were scarcely any plastics extruders in 1941 and the size of machines is constantly on the increase.

Mr. Landes also pointed out that today's machines are much more efficient than those available in the earlier days of plastics. They have a faster stroke, better design, improved heat control and more rugged construction.

Injection machines

Machinery manufacturers performed the unprecedented feat of delivering over 1500 injection presses in 1946. This is almost as many machines as the industry owned in 1945. There is no indication that this tremendous increase will continue into 1947 although all the largest producers of presses report orders on hand for several hundred machines.

When the United States entered the war in 1941, there were about 1000 injection machines in the industry, most of them of 2, 4 or 6 oz. capacity. The Government did not permit the building of a great many machines during the war, yet by the end of 1945,

Table II—Machines in the Plastics Molding and Extrusion Industry

Type machines	*1941*	*1944*	*1945*	*1946*
Injection	1,000	1,450	1,720	3,275
Compression	8,000	11,500	12,065	12,975
Extrusion	...	650	850	1,150

[1] "Plastic materials supply situation," MODERN PLASTICS 23, 116A-116D (May 1946).

Readers' opinions on outstanding developments in plastics in 1946

- Electronic preheating and plunger molding.
- Large castings from custom molds.
- Decorative effects from use of third dimension spraying.
- Increased production of polystyrene.
- Development of testing methods for finished products.
- Ability to go ahead under adverse conditions.
- Increased use of plastics in home furnishings and wearing apparel.
- Public acceptance of plastics.
- Push button control of press cycles.
- New sheet molding.
- Vinyl for substantial items (floor covering, for example).
- Production of perfect electroformed molds.
- Rapid transfer molding.
- Improvement of paper laminates.
- Polyethylene and nylon development.
- Free flowing diced Rogers Board advances.
- Expansion of raw material.
- Tool design improvement.
- Successful use of smaller injection presses (fractions of an ounce per shot).
- Improved and larger injection machines.
- Greater use of plastics in durable goods.
- Change-over from granules to pellets.
- Small power-operated machines.
- Improvement in moldability of urea.
- Plastics proving their worth in competition with other materials.
- Interest in high temperature styrene.
- Development of polyesters.
- Expansion of equipment and molding presses—manufacturing facilities.
- Injection molding of 5 lb. shots.
- Deep drawing of thermoplastics.
- Silicone laminates.
- Continuous low pressure laminate.
- Expanded cellular plastics for insulating.
- Textile fillers and coatings.
- Ability of resin manufacturers to make large amounts of resin to exacting specifications.
- Research into ways of decorating unsupported sheeting.
- Increased development of ethyl cellulose, silicones, Teflon.

the number had been increased to over 1700, of which more than 600 were 8 oz. or over.

Of the more than 1500 machines delivered in 1946, some 1100 had a capacity of 8 oz.; slightly more than 100 were less than 8 oz. (exclusive of laboratory machines); more than 150 were 12 oz., and the balance were 16 oz. or larger.

Today, we have approximately 3275 injection machines, of which at least 1600 are 8 oz. units and around 400 are 12 oz. or larger. In addition, there are at least 100 more injection presses which have been made by individual molders or to their order.

Compression presses

Any person who thought that the thermosetting section of the plastics industry was going to stabilize or decline after the war needs only to look at the number of machines delivered in 1946 to realize that molders have great faith in the future of thermosetting materials. More than 900 presses were delivered in this year to make the total number of compression presses in the industry close to 13,000. Of the 900 odd presses delivered, about 150 were 200 tons or larger.

A glance at Table II will show that no allowance is made for obsolescence of older machines, nor does the 13,000 include laboratory presses and small semi-automatics, many of which are made by the molders themselves. Laminating presses are excluded from these figures.

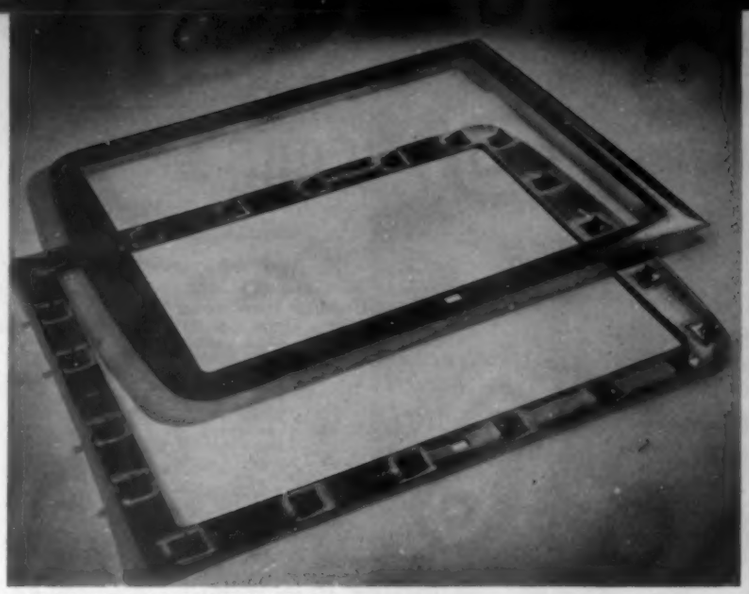
Extruders

It is difficult to obtain an accurate figure on extruders because manufacturers do not always distinguish between rubber and plastics extruders. Sometimes the machines can be used interchangeably for either material, and a machine designated for rubber extrusion may end up on a plastic job. There are no figures available for plastics extruders in 1941, but in 1944 there were approximately 650 extruders working on plastics, including those employed as wire coaters.

According to the best information available from manufacturers, about 200 extruders were delivered in 1945 for extrusion of plastics materials, of which a great portion was, no doubt, vinyl for wire coating. Manufacturers estimate that in 1946 approximately 300 machines were delivered primarily for plastics extrusion, bringing the total number of plastics extruders to 1150.

Sizes range from $1^1/_2$ to $8^1/_2$ in. with emphasis on the $2^1/_2$ and 3 in. category. But the demand for larger sizes is increasing. The amount of plastics material consumed per hour by an extruder varies considerably according to the job at hand, but, according to reliable estimators, a conservative average is:

Size of extruder	*Plastic consumed per hr.*
in.	*lb.*
2 or $2^1/_2$	25 to 50
$3^1/_4$ or $3^1/_2$	75 to 125
$4^1/_2$	160 to 230



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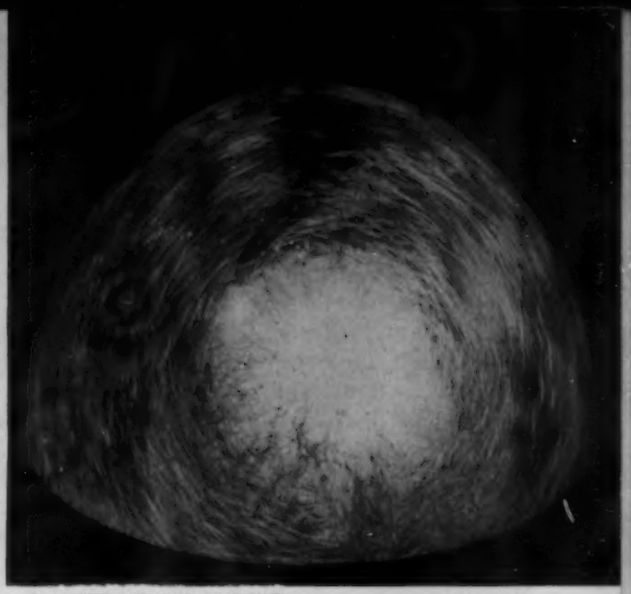


PHOTO, COURTESY BASSONS MOLDED PRODUCTS

Above (left)—A refrigerator inner door frame molded in 1 piece of a high pressure laminate. Above (right)—This lamp globe, impregnated with polyester resins is produced by means of male and female dies under pressure. In view of the high breakage of street lamps, this globe may offer a solution to the problem

Laminators see volume outlets ahead

THE laminating branch of the plastics industry was well covered in the September issue of MODERN PLASTICS,[2] and there is not much point in repeating the story here. As for the other aspects of this field, not enough manufacturers from this section of the industry returned their reports and it is not our intention to publish statistics based on inadequate returns. Further, the scores of new concerns entering the low-pressure laminating field these days are still in their formative state and render most estimates pure guesswork. The possibilities for this phase of plastics processing will be thoroughly explored in a special article to appear in an early issue of this magazine.

From the returns that *were* received it appears that laminators fared somewhat better in 1946 than did the molders in obtaining needed resinous materials for their work. Several reported receiving 100 percent of their orders and the average was between 75 and 80 percent until the last 3 months of the year when strikes curtailed resin production. There is a possibility that laminators might have done 20 percent more volume if they could have received all the resin desired. These companies' most trying shortages were in other raw materials needed for their products such as paper and fabric.

Building and transportation as outlets

Most of the laminators answering our questionnaire reported 30 percent less business in the first three quarters of 1946 than in the best war year but were expecting to do 50 percent more business in 1947 than in 1946.

Several of the larger companies have announced tremendous plant expansion programs to meet the demand of the housing program for kitchen furnishings, door panels, table tops and similar applications. The transportation industry including truck and freight car bodies is beckoning. The textile industry's state of flux in meeting the advance of synthetic fibers is also expected to result in a great demand for new machinery, many parts for which will be supplied by laminators as well as molders.

New developments in laminating

Among the most promising of the new developments is the progress made in curved laminates and the new methods worked out by the Briggs Manufacturing Co. for processing decorative resin-impregnated paper sandwich structures for use as interior automobile paneling. This latter work is described on pages 112 through 118 of this issue.

The progress of the industry during the last year is described by one of our correspondents who writes: "From January into August of 1945 we operated our paper treaters to full capacity and then experienced a very low production period from V-J Day to May of 1946. During 1946 we built 2 new treaters and in the first 10 months our actual production of treated papers was 10 percent higher than for the full year of 1945. Commitments for the months of November and December would indicate that our 1946 production will exceed our 1945 production by 50 percent."

[2] "What's ahead for high pressure laminates," MODERN PLASTICS 24, 91-98 (Sept. 1946).

Adhesives used in plywood

THE plywood industry is tied in with plastics because synthetic or plastic adhesives are the primary factors that have made plywood a more satisfactory material for all-around use. The amount of phenolic and urea resin used for this purpose has reached important proportions and is a much sought-for market among raw materials producers.

There are two types of plywood, namely, softwood and hardwood. Softwood is manufactured from coniferous trees such as fir, spruce and hemlock and is the type generally used for exteriors. It is processed by either the hot or cold press method with various types of glue such as casein, soy bean, dried blood, urea or phenolic. When intended for permanent outdoor use softwood plywood is generally processed with phenolic or urea.

Hardwood plywood is the type which utilizes wood from a great many species of deciduous or broad-leaved trees and, in general, employs all types of adhesives. According to Census figures a far greater poundage of urea than of other glues was used during the war years. Among the finished products made from hardwood plywood are boats, gliders, airplanes, cabinets, interior trim, radios, store fixtures, boxes and baskets.

Volume and uses of softwood plywood

Table III shows the amounts of glue used in softwood plywood processing the first three quarters of 1946. The 1,000,000,000 sq. ft. of softwood plywood processed with this amount of glue during 9 months is the same as the full year's production in 1939.

Authoritative sources believe that 1946 production scarcely reached 1,500,000,000 sq. ft., which was still considerably ahead of 1945 when a long strike hit the industry. It is estimated that the 1947 production will approximate the record output of 1,800,000,000 in 1942.

Volume and uses of hardwood plywood

The latest production figures for glue used with hardwood plywood are those of 1943 and 1944 (Table IV). It has been estimated that the 1946 production of hardwood plywood will be considerably below that of 1943 and that 1947 will be no better.

Table IV.—Glue Used in Hardwood Plywood[a] (in millions of pounds)

Year	*Casein*	*Soy bean*	*Phenolic*	*Urea*	*Tapioca*	*Other glues*	*Total*
			(in millions of pounds)				
1944	1	10	5	18	9	9	52
1943	1	10	6	16	12	9	54

[a] No statistics available for 1945 or 1946.

Only 60 percent of present hardwood plywood operations require synthetic resins due to fact that this plywood is not so largely used for exterior purposes. It is also possible that all West Coast softwood operations will eventually use synthetic resins in nearly all their output since this would make possible use of the finished plywood either inside or out.

New developments in plywood

An important development which seems about ready for full-scale production in 1947 is the manufacture of a phenolic resin laminated paper which, when bonded to plywood, will give a weather resistant material that could last for years and prove adaptable to home construction. This process would enable the softwood plywood industry to use their imperfect veneer as the outside ply since it would be protected by the phenolic surfacing material.

To show its faith in plywood as a structural material, one large company is building two all-plywood homes in Canada which will meet all kinds of weather conditions and which are expected to be permanent.

Another development coming in plywood is the United States Plywood Corp.'s new Flexwood, a thin wood veneer bonded to fabric with synthetic resin glue for use as a wall covering.

Other outlets with a good chance for great expansion in 1947 are Armorply, a plywood bonded to aluminum, and Flexmetl, a veneer bonded to metal. In both cases the result is a panel of considerable structural strength.

Table III.—Softwood Plywood Glue for First Three Quarters 1946

Month	*Casein*	*Soy bean*	*Phenolic*	*Other glues*	*Total*
	lb.	*lb.*	*lb.*	*lb.*	*lb.*
Jan.	336,000	1,761,000	1,818,000	213,000	4,128,000
Feb.	300,000	1,700,000	1,900,000	190,000	4,090,000
Mar.	294,000	1,737,000	2,008,000	159,000	4,198,000
April	403,000	1,878,000	2,051,000	158,000	4,490,000
May	519,000	2,010,000	2,390,000	187,000	5,106,000
June	502,000	1,879,000	2,001,000	172,000	4,554,000
July	438,000	1,617,000	1,531,000	145,000	3,731,000
Aug.	603,000	2,059,000	2,164,000	148,000	4,974,000
Sept.	527,000	2,287,000	2,194,000	185,000	5,193,000
Total	3,922,000	16,928,000	18,057,000	1,557,000	40,464,000

PHOTO, COURTESY U.S. RUBBER CO.

The effect of resin treatment of wool is evident in this picture where an untreated sweater, hanging on the clothesline, has shrunk considerably as compared to the same size treated sweater, the girl is wearing, which has also been laundered

Textile treating resins

TEXTILE treatment is a comparatively new field for plastics, but it is one whose potentialities are far reaching. It involves the use of synthetic resin for treating textiles to eliminate shrinking, minimize creasing and wrinkling, preserve crispness, give a permanent glaze, improve furs, better the pile in some fabrics, and impart a softer hand and other attributes. Many believe the textile field may one day consume as much plastics as does any other branch of industry.

The possible size of this outlet is still undetermined, but it has been estimated that of the 460,000,000 lb. of wool marketed in 1939 approximately 1/3 of it went into end products of a type which might have benefited from one of the resin treatments. Admittedly only a small amount of resin and plastic is used per garment, but the total poundage could be tremendous.

Either thermoplastic or thermosetting resin

Plastics used in textile and paper treatment may be either thermosetting or thermoplastic, though melamine has thus far received the most publicity. The only figures available on the quantity of resin presently going into this work are those in the Census reports which show about 10,000,000 lb. for the first three quarters of 1946. The 1947 consumption will likely exceed this figure by millions of pounds, but this is guesswork.

There are a number of characteristics that may be imparted to a garment by resin-impregnation, others that may be changed, if present experiments are successful. In addition to the resin treatments imparting the various qualities listed in the first paragraph of this article, there is a new material coming along that could be used to give wool a moth preservation treatment at the same time it treats it for shrinkage. Another resin compound might serve as a water repellent for wool. Further experiments may turn up a resin that will increase wear resistance.

Chief emphasis so far has been upon the resin treatments worked out by the American Cyanamid Co. and the Monsanto Chemical Co. to prevent wool shrinkage. It is easy to believe that when the general public learns that shrinkless wool can be made, there will be more sweater girls, and wrinkle-proof palm beach and tropical worsted suits will solve the summer clothing problem.

When the present inventory of wool fabrics is exhausted, one may wonder why wool should ever again be produced without the shrinkless treatment. The cost of melamine treatment raises the garment about one grade in cost, but the customer can quickly save that amount by eliminating dry cleaning expenses. The 8 to 10 percent resin solution used for treatment adds about 5 percent to the weight of the fabric.

The U. S. Rubber Company has two new fabric treating resins. One is an unclassified room-temperature setting resin to prevent shrinkage. The other, a thermoplastic resin, will preserve original starch-like crispness in fabric no matter how many times it is washed.

The Ceglin treatment of American Viscose minimizes lint, gives fabric a crisp, medium or soft hand as desired and makes the material resistant to laundering. It is thought to be a cellulose ester material. Other interesting developments are non-woven materials sold as disposable handkerchiefs, tea bags, table doilies, packaging material, curtains, tying ribbons, etc.

Life is just beginning for all the materials mentioned here. Watch them grow in 1947.

PHOTOS, COURTESY SANTAY CORP.

Above (left)—Three stages in production of polystyrene radio dial. This material has wide use in household applications. Above (right)—Ethyl cellulose, because it is strong and resists battery corrosion, is frequently used in flashlights

Expansion plans of materials suppliers

EVER since the close of the war, raw material manufacturers have been making announcements concerning their plans for expansion. During the last 6 months all these plans have been altered due to the inability of the companies to obtain supplies and equipment. The causes have been the same as for all other industry—strikes, catastrophes such as flood or fire, lack of enough raw materials, extraordinary demand.

As a result of these delays, most suppliers have been disappointed in meeting their building and new facilities schedules. They are loathe to talk about the situation and are exceedingly cautious about making promises as to when expansion programs will be completed.

However, we have attempted here to bring together all their announcements and give the reader as much information as we can on the progress of their plans.

American Cyanamid Co.—Late in 1945, this company announced a $2,000,000 expansion program which would double 1941 production of urea and melamine resins at its Wallingford, Conn., plant. It was expected that this program would be completed in 1946, but it is now doubtful that full planned capacity will be reached until the middle of 1947.

Even if the plant were completed, it is doubtful that enough urea crystal could be obtained to operate it at capacity. It is also possible that a shortage of melamine crystal may become evident during the next year.

American Molding Powder & Chemical Corp.—This company's cellulose acetate plant is now operating at a rate slightly above wartime production, but not at full capacity due to inability to obtain sufficient flake.

There are plans for the expansion in 1947 of the scrap plant operated by a subsidiary, A. Bamberger, in connection with this acetate plant. In addition to cellulose acetate, polystyrene will still be reworked and colored and vinyl resins remilled in increasing quantities.

Bakelite Corp.—Bakelite Corp. let it be known early in 1946 that it expected to double plastics production. Census figures indicate that the company was well on the way toward increased phenolic production when a strike in September cut off its output.

At present it is in the process of moving all plastics facilities from its research and development plant in Bloomfield, N. J., to Bound Brook where, in addition to phenolics, it announced that it expected to produce 25,000,000 lb. of polystyrene annually.

Urea molding powder production was stopped during wartime and facilities were used to produce molding powder for the frangible bullet. Production of urea molding material has not been resumed, although urea resin for adhesives will continue to be produced in increasing amounts.

Sometime during 1947, the wartime production of vinyl and polyethylene resins will have been doubled at the Charleston, W. Va., plant. Vinyl processing operations for the manufacture of film and sheet will be carried on at Bound Brook and in a new plant now under way near Ottawa, Ill. It is hoped that construction will be finished in both of these plants by late 1947. Other Bound Brook plans for this company include:

1. Adding to the building space for the production of vinyl chloride acetate polished sheet and high-gloss sheeting. Production capacity will be doubled.
2. Construction of a new building to accommodate the development laboratories.
3. Production of phenolic molding materials and phenolic resins will be substantially increased.

Celanese Plastics Corp.—In the fall of 1945 this company announced that it expected to double its plastics production within the next 2 years and was hopeful that the greatest portion of this expansion would be completed in 1947. Like all other material manufacturers, Celanese Plastics Corp. was delayed by inability to obtain building material and equipment. The plant at Newark, N. J., is now expected to be finished in the second quarter of 1947.

The Belvidere, N. J., plant, after a long delay in getting started, is now under way and should produce fairly substantial quantities of cellulose acetate molding material in 1947. This plant will eventually produce additional quantities of most of the products now being made at Newark as well as cellulose acetate and cellulose propionate flake. A new plant in South Carolina will come in during 1947 or 1948 which may add to the flake production for plastics.

Forticel, the propionate molding material which the company had hoped to produce in substantial quantity in 1946, will be in greater production in 1947. But full capacity is not expected until 1948.

Tricresyl phosphate, a plasticizer produced in Newark, is now running at a smaller rate than during the war due to raw material shortages. Plans are being considered for its expansion.

The new chemical plant in Texas will produce from natural gas a large number of materials for plastics and chemicals. It is now turning out, in quantity, supplies of acetic acid and acid acetaldehyde from which is derived acetic acid, normal propyl alcohol and propionaldehyde. Methanol has been produced there for the last 8 months and formaldehyde is now coming out in large quantities. Facilities were completed about 8 months ago and production is increasing daily.

Chemaco Corp.—This company announced a year ago that it expected to increase its production by 400 percent over the going rate at the close of the war. At that time the company was producing several hundred thousand pounds of cellulose acetate and ethyl cellulose material monthly. About one quarter of the 400 percent increase was accomplished in May 1946; it was one half completed in December 1946. It is hoped that the last piece of needed equipment will be installed by April 1947.

Most of the increase has been in ethyl cellulose. It was hoped that polystyrene production would reach a rate of something like 2,000,000 lb. by the end of 1946, but this date is being steadily advanced.

Durez Plastics & Chemicals, Inc.—A $2,000,000 expansion program for 1946 and 1947 was announced by this company in Buffalo newspapers late in 1945. It was then stated that the planned addition would double the company's capacity in 1940. The company is going ahead with this program despite pessimism over its ability to obtain raw materials.

Dow Chemical Co.—Early in 1946, Dr. Willard Dow announced that his company would spend $15,000,000 over a 5-year period to expand plastics production. Subsequently, however, the company did offer something like $14,000,000 for the styrene plant at Velasco, Tex., which is part of its plastics program. This appears to confirm the opinion held by many that manufacturers' estimates are conservative and that actually much more will be spent to produce plastics materials than the original estimates indicate.

Officials assert that their organization has been and probably will continue to be the major factor in the polystyrene business. Production increases have been delayed due to inability to obtain materials, but it is expected that they will be completed by the middle of 1947. These men anticipate that polystyrene will probably be in short supply for some time although this situation will be considerably alleviated after increased facilities make themselves felt. A contributing factor is the uncertainty of the styrene monomer supply which will be available for polymerization.

Small production increases for Ethocel were realized in 1946. No further large scale expansions are immediately forseeable. Saran production was approximately doubled in 1946, but further expansions are not scheduled before 1948.

A company official has stated that officers in the plastics section are shooting at a higher production target than they were a year ago. However, due to present uncertainties in building and equipment, he was unwilling to make a prediction upon which the company's customers could base their decisions as to whether or not they should undertake to increase their processing facilities.

E. I. du Pont de Nemours & Co., Inc.—This company has not announced an over-all figure for plastics production but now has in the process of construction a new and thoroughly modern plastics plant on a 400 acre site at Washington, W. Va. It was started in midsummer of 1946 and will represent an additional plant to the one located at Arlington, N. J., which is reputed to be one of the largest plastics manufacturing plants in the entire country.

The construction program at Washington has been delayed from 6 to 9 months. The original construction facilities at this plant will be for the manufacture of acrylic molding powders and for nylon bristles, molding powders and sheets. There will also be a unit for compounding polythene molding powder. The plant is scheduled to come into full operation during the fall of 1947. In addition, the company is building a new polythene plant at Orange, Tex., which should be in full operation by late 1947.

B. F. Goodrich Chemical Co.—This company has announced that it expects to double its wartime production as rapidly as possible. It has purchased from the Government the 60,000-ton capacity polymerization plant at Louisville, Ky., which was formerly used for GR-S synthetic rubber and a portion of which is being

converted into an additional source for the company of polyvinyl chloride.

The company expects to reach its goal of double its wartime production by the fall of 1947. The Niagara Falls, N. Y., and Louisville, Ky., Geon plants have been running at full capacity during all of 1946.

Hercules Powder Co.—No major expansion in production facilities for cellulose acetate flake were made by this company since 1941, but substantial new production will begin after the third quarter of 1947. There has been a small increase in total output of cellulose nitrate, but no new plant facilities.

Ethyl cellulose facilities were increased 60 percent in 1945 and no new facilities are planned for 1947. Census Bureau production figures show a rise in the total output of ethyl cellulose of from less than 800,000 lb. monthly in 1945 to 1,400,000 lb. during July 1946.

An interesting addition to the Hercules establishment has been the development of a pilot plant to produce cellulose acetate laminates. This plant, which began operation in 1946, is only for developmental purposes to promote the production of the laminates by other companies.

Interlake Chemical Corp.—This company purchased Makalot Corp., of Boston, during the war at a time when Makalot produced an estimated annual 15,000,000 lb. of phenolic resin and molding powder. Interlake states that its plans for the years 1947 and 1948 are far from complete and that it has been considerably delayed for reasons affecting all industry.

Koppers Co.—Last July this company bought from the government the Kobuta, Pa., styrene monomer plant which it had been operating. During the war, this plant had a monomer capacity of 37,500 short tons. The company is now planning to build a polystyrene plant near the monomer plant which will have an annual capacity of 15,000,000 lb., but officials doubt that it will come into production during 1947. A pilot plant is now producing about a ton of polystyrene per day.

Popular applications for high-gloss vinyl sheeting and cellulose acetate lie in the purse field. Here, 2 handbags have vinyl pouches and molded cellulose acetate frames

PHOTO, COURTESY COLUMBIA PLASTIC AND HERMAN LOEWENSTEIN

Glenn L. Martin Co.—A new plant is under construction at Painesville, Ohio, which will have an annual capacity of 25,000,000 lb. of a vinyl-type plastic. The initial unit will be in production in the spring of 1947 with full capacity reached about a year later.

Monsanto Chemical Co.—Expansion announcements from this company's Plastics Division in 1946 have all concerned increases in the production of polystyrene molding compound. An announcement on August 29 was that the company would have facilities for 80,000,000 lb. of molding polymer by early 1947.

In August, the government-built and Monsanto-operated styrene monomer plant at Texas City, Tex., was bought for $9,550,000. It was designed to produce 50,000 tons of monomer annually. At that time, Felix N. Williams, general manager of the Plastics Div., announced the installation of an additional polystyrene production plant adjoining the Texas City plant. With the Canadian and Springfield, Mass., plants, this would give the company a capacity of 80,000,000 pounds. Most of the polymerization will be done at Springfield. In August, Mr. Williams said that 50 percent of the styrene output capacity which was under construction at Springfield was already in production.

Plaskon Div., Libbey-Owens Ford Glass Co.—A $5,000,000 program of construction was announced by this company early in 1946—the facilities to be used for plastic resin manufacturing and be located in Toledo and to include the Paramet Corp., an affiliate located in Long Island City. Another plant will be built later for the manufacture of adhesives and other specialty products. It was expected that the resin manufacturing plant would be completed by late July 1946, but completion date now is scheduled for the spring of 1947.

Reichholds Chemicals, Inc.—Production of this company's phenolic resin adhesives and varnishes, hitherto manufactured in its Detroit and Tuscaloosa plants, will be extended to three West Coast plants in Seattle, Elizabeth and South San Francisco. The first year's resin production at Seattle alone is expected to be in excess of 25,000,000 lb., and there will be additional increases at Detroit and Tuscaloosa. The West Coast production is primarily for the plywood industry.

Tennessee Eastman Corp.—Late in 1945 this company announced that by April of 1946 it expected to have about 25 percent additional capacity for the manufacture of cellulose acetate and cellulose acetate butyrate. This was to be followed later by another 10 percent increase. Construction delays have prevented consummation of this program. Company officials believe that the 25 percent increase announced for 1946 will become available in the first quarter of 1947.

The raw materials situation

PLASTICS materials manufacturers may be pardoned if they emitted a sigh of relief when the old man with a scythe cut down the year 1946. Practically everything evil happened to them—topped by the recent coal strike which seemed to be the proverbial last straw. In addition to shutdowns caused by four major and several minor strikes there were fires, floods, delays and failures in delivery of new equipment and construction materials, lack of shipping containers and shortages in nearly all basic materials and components needed by the industry. Shortage of various chemicals is such a serious threat to the planned expansion of the plastics industry in future years that it will be covered in detail in a later issue of this magazine.

In view of all their handicaps it is amazing to find that in August of 1946, according to P.M.M.A. General Manager Frank Carman, the raw materials industry was producing at a rate of 140 percent of 1945 for resins and cellulosics and almost 50 percent ahead of 1945 in molding materials alone. Production figures as indicated in charts on pages 102, 104, 105, 106, 107 are sufficient to show that users of plastics fared as well or better than processors in other industries. But the demand was so great that customers sometimes failed to realize that their consumption was running ahead of all previous records. It is quite possible that the situation may be remedied in 1947 with the possible exception of phenolics.

The picture for 1947 is certain to remain muddled until these knots are untied, and as Mr. Landes points out in his message on page 110, price problems and labor difficulties, plus possible threats of "money panics," may result in receding rather than expanding markets.

It should be emphasized that today's world's supply line is on a cockeyed basis with surpluses already showing up in some spots. Until this unevenness is leveled out, there will always be trouble. The chemical industry, in particular, is a highly integrated unit and such things as coal strikes have far more effect than fuel shortages. For example, if the steel industry shuts down there will be no coke, a by-product of which is coal tar. When coal tar is not available there will be no benzol, no phenol, no phenolic resin, no styrene, no polystyrene. Neither will there be naphthalene from which to make plasticizer for cellulosics and vinyls.

However, we made our estimates, even in the midst of the coal strike, on the theory that rational people will not commit economic suicide and that fairly normal trends of supply and demand will determine the output in 1947.

Cellulose acetate, cellulose acetate butyrate

As Mr. Frank Carman, P.M.M.A. general manager, pointed out in his October survey, producers increased 1946 production of cellulosics far more than they had hopes of doing in late 1945. If they have any luck at all in fulfilling their 1947 schedule they should reach the estimated 131,000,000 lb. total, or approximately 30 percent increase, shown on page 104.

Chief problems in the supply line for cellulosics have been lack of sufficient facilities to produce the amount of flake needed, shortage of cotton linters, a lack of coloring pigments and unavailability of plasticizers. There is little likelihood for greatly improved availability in any of these supplies for 1947 so it is quite evident that producers will have difficulty in meeting their planned increases for 1947. However, they did it under even more extreme circumstances in 1946 and may repeat in 1947.

The cotton linters supply which is basic for most cellulose acetate flake is in a confused state. Ginned cotton seed from which the linters are obtained has four markets—oil, meal, hulls and lint. Oil mill operators may hold the seed for whichever one of the four markets promises the highest price before selling. In days of a scarce economy that situation means not only difficulty in obtaining linters but a constantly rising price which Mr. Landes points out in his article on page 110. It is easier to understand the price rise in acetate plastic when it is realized that cotton linters have gone up from $3^{3}/_{10}$ to more than 9 cents and are still rising.

Wood pulp is used to some extent but, at present, is not suitable for crystal cellulose acetate and, according to some chemists, its use limits range of colored molding material. Furthermore, if the industry is forced to change over to wood pulp from cotton linters it will take a year or more to build new plants. Continued high prices for cotton linters may force the issue.

Dyes, pigments and plasticizers—Dyes, pigments and toners are scarce because of the great demand for them by the paint industry. Pigments, generally obtained from minerals, and insoluble in oils and solvents, are most difficult to obtain. But they are just as necessary as soluble dyes for cellulosic plastics. Many of them were imported before the war. Very few, if any, proposals have been made for increasing the production and, consequently, there is genuine fear over the manufacturers' ability to continue the wide color range now in vogue. Indeed one company is said to have increased its cellulose acetate production by 15 percent by cutting back the number of colors available.

The plasticizer situation is treated on page 108 of this article, but it cannot be emphasized too strongly that the plasticizer shortage results in the use of substitutes which degrade the quality of the product and seriously affect entire plastics industry. (*Please turn to next page*)

Scrap material—Another source of considerable volume today is cellulose acetate scrap although no definite figures are available. It comes from three sources:

1. Cut off sprue and gates from molded items.
2. Rayon flock.
3. Reclaimed movie and camera film.

It has been estimated that at least 100,000 lb. of rayon flock is being processed monthly to give from 90 to 95 percent cellulose acetate material, but the color range is limited according to the material that is being reworked. Much of it is colored black and for limited purposes it is satisfactory.

Reclaimed movie and camera film is thought to be available at the rate of about 500,000 lb. a month and reworking has the additional incentive of reclaiming silver as well as acetate or nitrocellulose. Furthermore it is ideally plasticized, an especially favorable factor in this day of shortages.

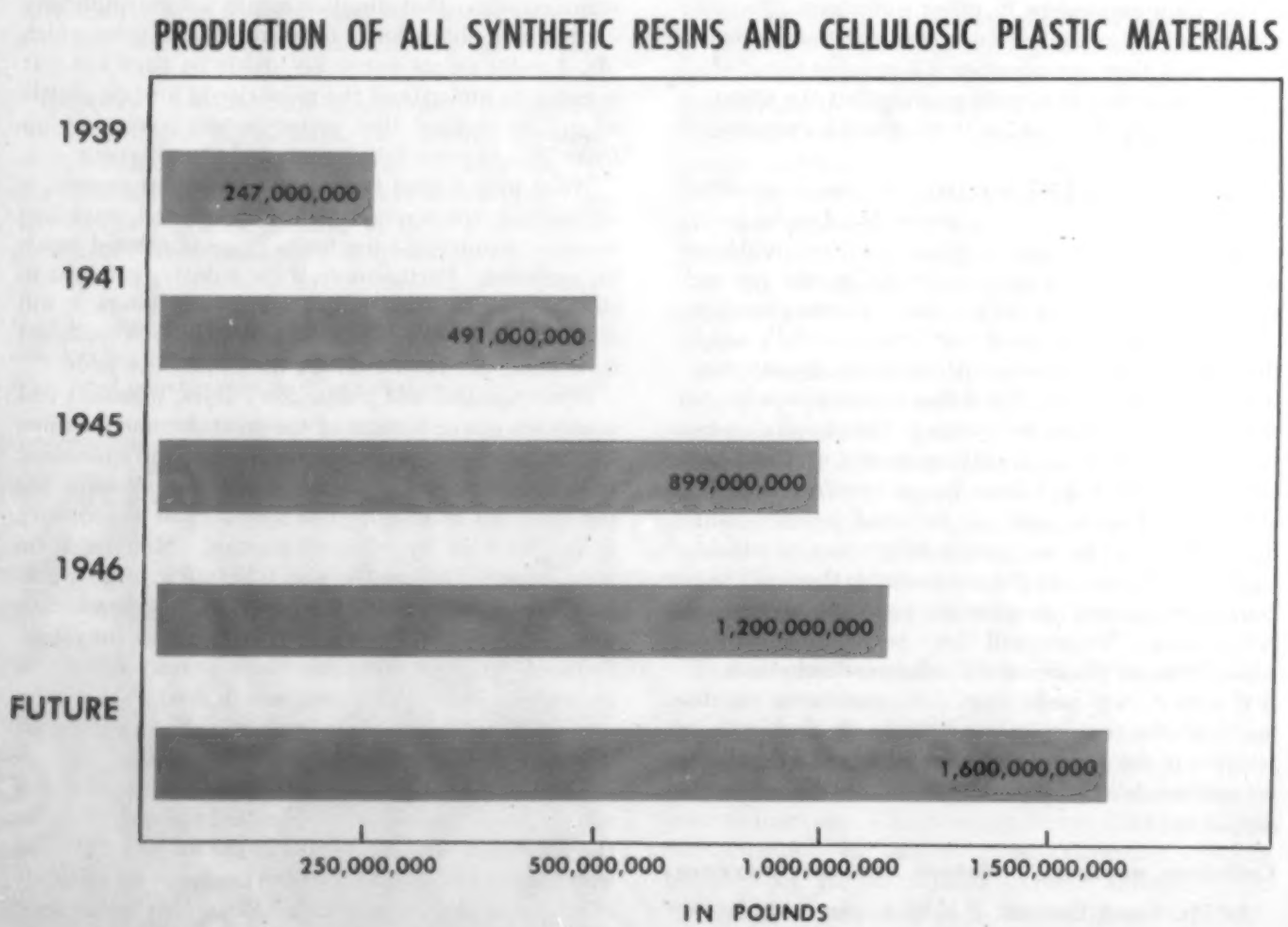
Cellulose acetate sheet—A most significant factor in the cellulose acetate picture is the growth of sheet production. The highest prewar total for all cellulose acetate sheets, rods and tubes was 13,200,000 lb. in 1937, a figure that had already been exceeded in the first three quarters of 1946. Production may go to 26,000,000 lb. in the year 1947. It is expected that packaging will take a great part of this increased production especially when the trend to package fresh fruits and vegetables comes into full bloom. Other applications which seem to be on the upgrade for sheet and rod stock are printed products such as calendars, price cards, greeting cards and playing cards, lamp shades, optical frames, sequins, radio and watch crystals, lenses for flashlights and goggles, table mats, decorative buttons, handbag frames.

A highly interesting speculation for 1947 is the prospect that some producer may announce that he has found a way to reduce substantially the cost of his esterification process. It is rumored that experimentation is under way, but naturally no comment is expected until the findings are definite.

Cellulose nitrate

In 1946 cellulose nitrate production equaled its greatest year, 1937. Producers are expecting no decline in 1947 unless there is a general slump in everything. Experts have been predicting a decline in cellulose nitrate for years. However, one company seriously consid-

Approximately 35 percent of yearly totals is synthetic resin used in the manufacture of paint, varnishes and lacquers. Total also includes plasticizer and filler used with cellulosics, but does not include plasticizer used with vinyls or paints, nor filler used with thermosetting compounds. Figure given for 1946 is production rate achieved in August 1946; that given for future is ultimate rate when all present expansion plans are completed

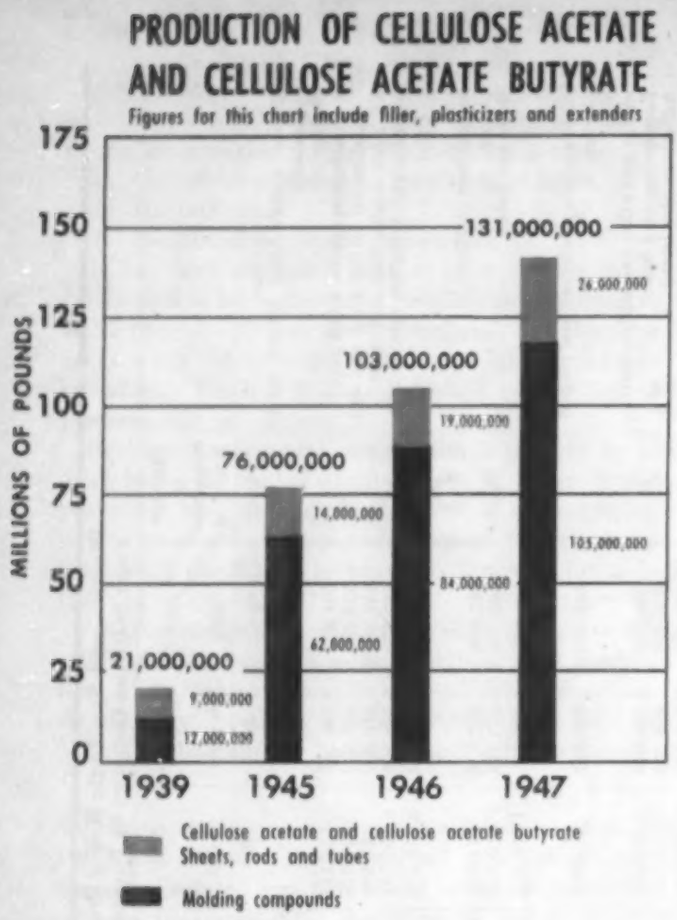


Plastics and Synthetic Resin Production (Jan. 1 Through Sept. 30, 1946)

From Statistics Compiled by Bureau of Census, Industry Division, Chemical Unit

	Number of companies reporting	*January*	*February*	*March*	*April*	*May*	*June*	*July*	*August*	*September*	*Total for first 9 months of 1946*	*Highest monthly rate*
		lb.	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*	*lb.*
Cellulose acetate and mixed ester plastics[a]:												
Sheets:												
Continuous (under 0.003 gage)	3	591,872	596,355	656,114	696,486	627,583	690,011	770,495	601,625	652,110	5,882,651	770,495
Continuous (0.003 gage and up)	3	524,883	541,542	677,978	664,833	591,277	751,572	687,416	519,286	541,258	5,500,045	751,572
All other sheets, rods and tubes	5	447,364	410,867	417,599	499,240	424,612	384,765	425,370	388,359	342,070	3,740,246	499,240
Molding and extrusion materials[a]	12	6,689,778	6,024,690	6,503,781	7,181,193	7,251,398	6,735,990	7,166,800	7,242,206	7,001,038	61,796,874	7,251,398
Total		8,253,897	7,573,454	8,255,472	9,041,752	8,894,870	8,562,338	9,050,081	8,751,476	8,536,476	76,919,816	
Nitrocellulose plastics[a]:												
Sheets	8	905,696	822,120	911,081	1,048,108	907,550	864,420	921,163	909,438	937,695	8,227,271	1,048,108
Rods and tubes	7	608,576	613,116	609,841	665,853	624,857	564,629	602,614	629,477	577,635	5,496,598	665,853
Total		1,514,272	1,435,236	1,520,922	1,713,961	1,532,407	1,429,049	1,523,777	1,538,915	1,515,330	13,723,869	
Methyl and ethyl cellulose and related plastics	4	848,634	800,827	935,965	1,063,984	1,016,419	1,137,802	1,451,488	1,118,257	877,216	9,250,592	1,451,488
Phenolic and other tar acid resins:												
Laminating (dry basis)	16	2,298,813	1,806,919	2,052,005	2,404,966	1,809,303	2,573,412	2,338,486	3,068,525	1,936,652	20,289,081	3,068,525
Adhesives (dry basis)	13	1,070,902	991,233	1,194,389	1,258,188	1,317,144	996,569	1,199,637	1,481,024	1,526,767	11,035,853	1,526,767
Molding materials[a]	14	10,739,472	10,606,487	12,286,204	12,483,690	13,453,292	14,161,634	14,190,536	14,640,213	8,618,056	111,179,584	14,640,213
All other (dry basis)[b]	15	4,415,637	4,331,994	4,229,231	5,314,081	5,437,693	4,818,844	4,977,055	5,949,009	3,993,668	43,467,212	5,949,009
Total		18,524,824	17,736,633	19,761,829	21,460,925	22,017,432	22,550,459	22,705,714	25,138,771	16,075,143	185,971,730	
Urea and melamine resins:												
Adhesives (dry basis)	11	2,650,044	2,794,506	3,224,959	3,314,027	3,477,628	2,596,207	3,371,475	4,290,229	2,773,548	28,492,623	4,290,229
Textile, paper treating (dry basis)	9	1,071,084	995,776	1,034,940	1,012,742	890,270	886,620	1,303,859	1,475,196	1,119,799	9,790,286	1,475,196
All other (dry basis)[b, f]	3	235,687	167,559	130,296	186,583	262,132	145,115	263,649	294,649	...[g]	1,685,670	294,649
Total[b]		3,956,815	3,957,841	4,390,195	4,513,352	4,630,030	3,627,942	4,938,983	6,060,074	3,893,347	39,968,579	
Polystyrene	5	2,728,623	3,007,122	4,011,334	4,950,626	5,159,798	5,639,484	5,746,830	5,725,860	5,347,902	42,317,579	5,746,830[i]
Vinyl resins:												
Sheeting and film	4	1,569,044	1,665,666	2,161,230	2,243,370	2,375,298	1,857,160	2,107,886	2,426,090	1,053,642	17,459,386	2,426,090
Textile and paper coating resins (resin content)	8	1,650,026	1,034,511	1,688,890	1,436,258	1,397,337	1,234,522	2,134,392	2,909,605	3,102,728	16,588,269	3,102,728
Molding and extrusion materials (resin content)[c]	4	5,496,024	5,910,429	4,718,281	5,265,325	4,665,924	4,978,168	5,511,569	4,874,830	4,885,718	46,306,268	5,910,429
Adhesives, all other (resin content)[b]	9	724,668	979,395	1,276,241	1,804,105	2,187,521	2,402,566	2,972,245	2,733,266	2,791,814	17,871,821	2,972,245
Total[b, h]		9,439,762	9,590,001	9,844,642	10,749,058	10,626,080	10,472,416	12,726,092	12,943,791	11,833,902	98,225,744	
Miscellaneous plastics and resins:												
Molding materials[a, c]	6	3,798,938	3,697,892	4,498,263	4,375,061	4,521,080	3,712,434	4,951,969	4,829,835	4,566,985	38,952,457	4,951,969
All other (dry basis)[b, d]	15	2,630,148	2,612,440	2,731,042	3,061,520	2,837,187	2,191,560	3,695,753	3,329,176	3,086,083	26,174,909	3,695,753
Total[b]		6,429,086	6,310,332	7,229,305	7,436,581	7,358,267	5,903,994	8,647,722	8,159,011	7,653,068	65,127,366	
GRAND TOTAL		51,695,913	50,411,446	55,949,664	60,930,239	61,235,303	59,323,484	66,790,687	69,436,155	55,732,384	531,505,275	

[a] Includes filler, plasticizers and extenders. [b] Excludes data for protective coating resins. [c] Includes data for urea and melamine, acrylic acid and miscellaneous molding and extrusion materials. [d] Includes data for petroleum resins, acrylic acid ester resins, mixtures and miscellaneous synthetic resin materials. [e] Includes filler and plasticizer for months of January and February only. Other months all based on resin content only. March figure based on filler and plasticizer content would have been 6,664,970 pounds. [f] Urea and melamine molding materials included with miscellaneous molding materials. [g] Not available. [h] Total vinyl figure is confused because of variations in company reports to Census Bureau. Revisions were not available at time of going to press but it is estimated that total vinyl production (resin content only), exclusive of protective coatings, was well over 100,000,000 pounds for the first three quarters of 1946—totaled almost 150,000 pounds for the year, of which total about 1,125,000 was vinyl chloride and copolymers. [i] October figure, received at press time, was 9,100,000.



The last three months for 1946 were estimated as was the total for molding compounds, and for sheets, rods and tubes in 1947. These last figures were marked out on the basis that normal construction and operating procedure will not be unduly disturbed by acts of God or man

ered building new facilities for nitrate in the past year.

End uses—The fact remains that nitrate continues to be one of the most satisfactory materials for fabricating and certain markets (fountain pens and optical frames) naturally gravitate toward it. One customer wanted 1,000,000 lb. a month for pens alone. Other big outlets are coverings for wooden shoe heels, toilet seat laminations, toothbrush handles, tool handles, hammer faces, ping pong balls, dolls, toys and games, buckles, bag frames, playing cards and sight gages.

It is also used on dashboards of nearly all automobiles where a wood finish is photographed on a sensitized sheet of nitrocellulose which is then covered with a clear coating and bonded to metal.

Production figures (in millions of lb.) are as follows:

Material	*1939*	*1945*	*1946*[a]	*1947*[b]
		(*millions of lb.*)		
Sheets, rods, and tubes	13	15	18	18

[a] Last 3 months estimated.
[b] Estimated.

Another wide use for cellulose nitrate is as a coating for fabrics and paper to form a leather-like goods known as "pyroxylin coated" and used for upholstery, book binding, balls of all types, pocketbooks and similar uses. About 75,000,000 lb. of pyroxylin was spread in 1946 in comparison to 60,000,000 in 1945.

Ethyl cellulose

This material moved up to a production of over 1,000,000 lb. monthly in late 1946 as shown on page 103. Because it is in a slightly higher price range than other volume-produced thermoplastics, producers do not expect it to reach monumental figures, but it has specialty uses that indicate a good healthy future. Its toughness, heat resistance and dimensional stability are very good. Developers are still working on minor color weaknesses.

Outlets for ethyl cellulose—A radio manufacturer seems convinced the material has unusually good characteristics as a cabinet and points out that because of its "softness" the cabinet gives superior sound reproduction free from harshness and reverberation. Because of its dimensional stability, bag frames, cigarette cases, razor boxes and handles and all box-like moldings have been found particularly applicable in this material since it became more obtainable in 1946. Advertising displays that are subject to high heat in windows and other store locations have found ethyl cellulose satisfactory. Injection molded tool handles, clock cases, refrigerator parts are other prospective markets.

About 80 to 85 percent of the material is now going to molders and extruders, but other uses are developing. One is a lacquer for coating ignition cables. It is also successfully used as a lacquer for linoleum coatings.

As a protective, strippable coating for metal parts, it made military history and is now being commercially exploited for that purpose.

The packaging field is still practically untouched by ethyl cellulose but as a hot-melt or other coating material for paper it is thought to have great possibilities and may also be used as a film for food packaging.

Phenolic molding powder

Apparently phenolics were the scarcest of all molding materials during the year 1946 despite the increased production rate of from about 10,000,000 lb. monthly during the war to a high of 14,640,000 lb. in August.

This record was established with little additional equipment, being due largely to improved plant efficiency which in turn was helped by an increased supply of labor. One plant director also suggested that the increase could be attributed in part to material manufacturers' ability to concentrate on all-purpose compounds rather than on the highly specialized materials required by military specifications during the war. The same organization reported a noticeable trend toward heavier and larger molded pieces which, coupled with doubled or tripled processing speed brought on by greater use of electronic pre-heating and plunger molding, was no doubt responsible for the molders' increasing demands.

Strikes and shortages—Probably no branch of the industry was more affected by strikes. In addition to the September to December shutdown by a large producer,

the rail and coal strikes in early 1946 were particularly distressing. The coal strike interfered with the steady production of coke, thereby cutting off coal tar and the resultant chemicals such as benzol, phenol and cresol, without which there can be little phenolic or cresylic compounds. A summer strike in the plant of a large phenol manufacturer added to the confusion.

The formaldehyde situation was far from stable due to a methanol shortage and unforeseen demand. It is believed that relief will not be evident until the second quarter of 1947. Added to the chemical shortage was a year-long scarcity of woodflour for filler that eased at the end of the year but will remain tight in 1947.

The settlement in December of both the coal strike and the large raw material producer's strike may be a good omen and make possible an increase, for molding powder alone, of perhaps 20 percent over 1946. However, from the needed amounts listed by various molders in their replies to our survey, that is one increase which is *not* going to meet demand if the country continues its buying spree. Further, manufacturers are pessimistic over ability to obtain enough phenol and formaldehyde in 1947 to keep expanded capacity in full operation.

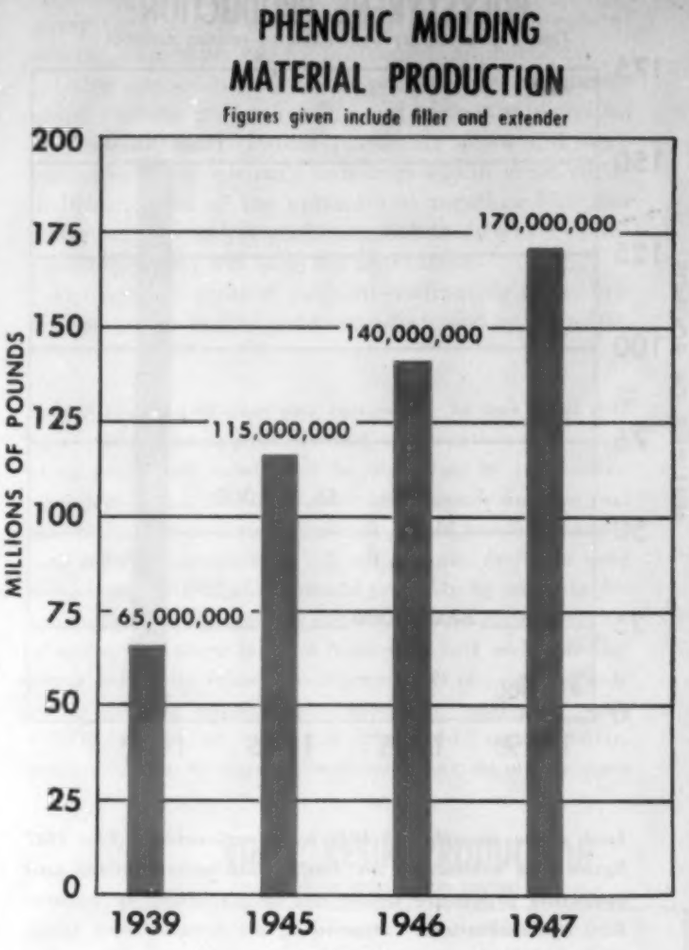
Urea and melamine

Although new facilities are expected to come in during 1947 to double capacity for the molding powders, it appears that producers of these materials have several new outlets, in resin treating and adhesives, for example. The individual demand for urea and melamine molding powder, as indicated by this magazine's survey, is just about as great as that for phenolic although on not such a great poundage basis. Compression molders seem intent on pushing their urea business. As in phenolics, it seems that much larger pieces are being molded—the chest for silverware shown on page 91, for example.

During the war, urea and melamine molding powder production was running from 2,000,000 to 2,500,000 lb. a month and increased to approximately 3,000,000 lb. monthly through 1946.

Base material shortages—The outlook for 1947 is clouded by a lack of knowledge on how much urea crystal will be available. No new plans for the plants to manufacture the crystal have been announced although newspaper stories assert that E. I. du Pont de Nemours & Co., Inc., had asked C.P.A. to approve an application for a new plant to come in during 1948. Urea is widely used in fertilizer compound and in cattle feed, both of which make tremendous demands upon the present capacity. It seems that until this demand decreases, there will be no more urea than at present for plastics, and producers of molding powder with new capacity coming in this year may well wonder where their urea crystal is coming from.

Melamine application—Melamine used with various fillers such as alpha cellulose is probably in its infancy though its higher price range is still a deterrent to competition with other thermosetting materials.

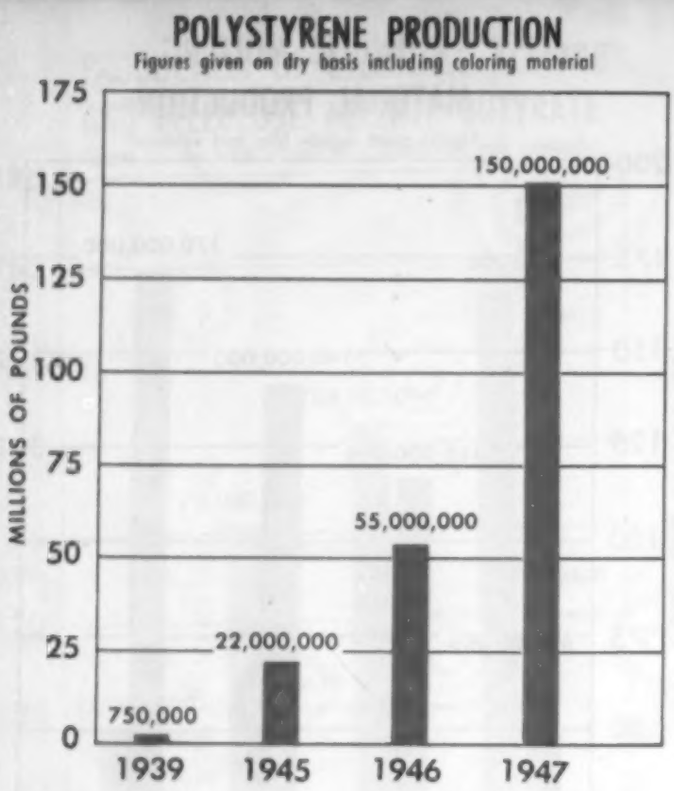


The figures for 1945 are conflicting, but production was seriously affected by materials and manpower shortages in early 1945 and by readjustments during the closing months of war. Actual capacity when material and manpower was available was figured at 12,000,000 lb. monthly in 1945, but reached 15,000,000 in August 1946. The last three months of 1946 were estimated. The total was arrived at by weighting figures, due to months-long strike of a large producer. As for 1947, this was estimated on basis that construction and operating procedure will not be unduly disturbed by acts of God or man

However, because of qualities such as arc resistance, and abrasion, high temperature and water resistance, and high impact strength it has many specialty uses such as electrical panel boards. The general public is familiar with decorative laminates where melamine is the surface ply, but industrial users are comparatively unacquainted with its possibilities as an industrial tool where it can be used as a laminating resin with paper or fabric. To date, most such uses have been with glass. Heavy restaurant dishes molded from melamine are currently on trial and, if satisfactory, will open a big market.

Polystyrene

Most sensational increase in production for any plastic during 1946 was polystyrene. As shown by the chart



Last three months of 1946 were estimated. The 1947 figure was estimated on basis that construction and operating procedure would not be disturbed by unforeseen circumstances. Depending on demand and speed with which new facilities are completed, the 1947 figure could be increased by 25,000,000 to 50,000,000 pounds. If all of the companies completed all facilities now being considered, a possible rate of production would be at least 240,000,000 lb. a year but it is doubtful they will be ready for full capacity operation until mid-1948

above, it jumped from 22,000,000 lb. in 1945 to over 60,000,000 lb. in 1946 which total varies slightly from that shown in the chart due to a last minute production figure which was not available when the chart was made. The total for 1947 may exceed 150,000,000 lb. and 1948 could go over 200,000,000 lb. if all companies now planning to come into production meet their schedule.

Company plans—The Dow Chemical Co. has anannounced no poundage figure but asserts that it expects to remain the leader in the field. According to Government publications, this company operates a 12,500-ton styrene monomer plant in Midland, Mich., a 10,000-ton monomer plant in Sarnia, Canada, a 25,000-ton monomer plant in Los Angeles, and a 50,000-ton plant in Velasco, Texas. It is negotiating with the Government for the purchase of this latter plant.

Last August the Monsanto Chemical Co. purchased for $9,550,000 the government styrene monomer plant which it had been operating in Texas City, Texas. This plant has a nominal capacity of 50,000 tons of monomer annually but like the Velasco plant can be operated at a much greater rate. The company has announced that it expects to be producing polystyrene at a rate of 80,000,000 lb. in 1947. It is believed in the trade that if pushed hard enough, the capacity of the new facilities would be 100,000,000 pounds.

The Koppers Co., of Pittsburgh, has announced that it expects to produce at least 15,000,000 lb. annually in a plant adjacent to its 37,500-ton monomer plant at Kobuta near Pittsburgh, Pa. Officials are not optimistic that this plant will be ready for large scale production in 1947. Construction has not yet started.

The Bakelite Corp. has announced that it expects to produce 25,000,000 lb. of polystyrene annually.

Several other companies—Chemaco being the only one to make a public announcement—hope to produce in comparatively small quantities of from 2,000,000 to 5,000,000 lb. a year if the demand warrants it. It is easy to see that if enough people want it, the industry may be running at a rate of over 200,000,000 lb. in 1948.

The amount of styrene monomer available for plastics depends upon the rubber program. Total monomer production is somewhere around 400,000,000 lb. Synthetic rubber requires three parts butadiene to one part styrene. One pound of polystyrene can be made from 1.03 lb. of monomer. Consequently it can be seen that if the synthetic rubber program is continued on a 400,000 or 500,000 ton basis there may be difficulty in obtaining enough styrene to meet the full anticipated expansion program for polystyrene.

Styrene outlets—Styrene is a most interesting chemical, with an uncharted field for development. Practically all that is being polymerized today is used for standard molding powder, but when demand slacks off it can be channelled into various fields. Because of its unique characteristic of a molecular weight that can be varied from 2,000 to over 100,000, the material offers a wide diversification of end use. Formulations can be built that will have special characteristics such as high heat resistance or greater flexibility. One authority has stated that the time may come when, for 10 or 15 cents more per pound, compounds will be made to order.

Either the monomer or polymer have possibilities for impregnating, bonding and laminating for coatings of all types and for adhesives and extrusion. One company has already announced that perhaps 24,000,000 lb. of the monomer will be consumed in protective coatings alone in 1947 where it can be used as a supplement to dehydrated castor oil, soybean and linseed oil. As a foamed or fibrous substance, polystyrene is already being suggested as an insulation material. The monomer is also a basic element in most polyester resins that are on the market for low pressure or contact laminating.

Because of its low price—25 cents in carload lots for crystal and 32 cents for colored—and its low specific gravity, molding powder is sought by injection press operators. Many of them have expressed the opinion that it is more difficult to handle than other materials because of the difficulty in cutting off gates, a longer curing cycle and a tendency to shatter when used in complex molds that have thin walls. However, many have already developed special means for removing gates and experience will remove other difficulties.

Vinyl resins

Many authorities believe that the vinyl family is headed toward the top production figure among all plastics. It has already risen from a prewar figure of around 1,000,000 lb. annually to a rate of approximately 145,000,000 lb. in 1946.

Plans for increased production in 1947 are rapidly taking shape. The two principal producers of vinyl chloride and copolymer combinations are the Bakelite Corp. and the B. F. Goodrich Chemical Co. They expect to double production as soon as possible and will bring in a great share of this added amount in 1947. One of them has announced that its new capacity will be in full operation by the fall of 1947.

Companies interested in vinyls—There are several other companies interested in this field. The Glenn Martin Co. has announced that it will come into production in 1947 with a plant built to a 25,000,000 lb. annual capacity. The Goodyear Rubber Co. started production in its Niagara Falls plant late in 1946, and it is rumored that the immediate production goal is approximately 12,000,000 pounds. Dow Chemical Co. has manufactured monomer for its own use and sold it to other firms on a small scale. Presumably it will be ready to add vinyl chloride to its line when time is ripe.

The Monsanto Chemical Co. is also a likely prospect for further contribution to the vinyl chloride total. The Shell Oil Co. is said to be considering production of vinyl chloride on a fair sized scale and Firestone Rubber Co. is also on the rumor list. It is known that American Cyanamid Co. made an extensive survey of the field, but its decision has not yet been announced.

Our estimate for 235,000,000 lb. of all vinyl resin in 1947 in comparison to 145,000,000 lb. in 1946 would be a conservative estimate if it were possible for all these companies to produce in volume quantity during the coming year. It may even be possible to reach a figure between 250,000,000 and 330,000,000 lb., but more conservative estimators in the industry figure that there is little likelihood of such capacity being reached in 1947.

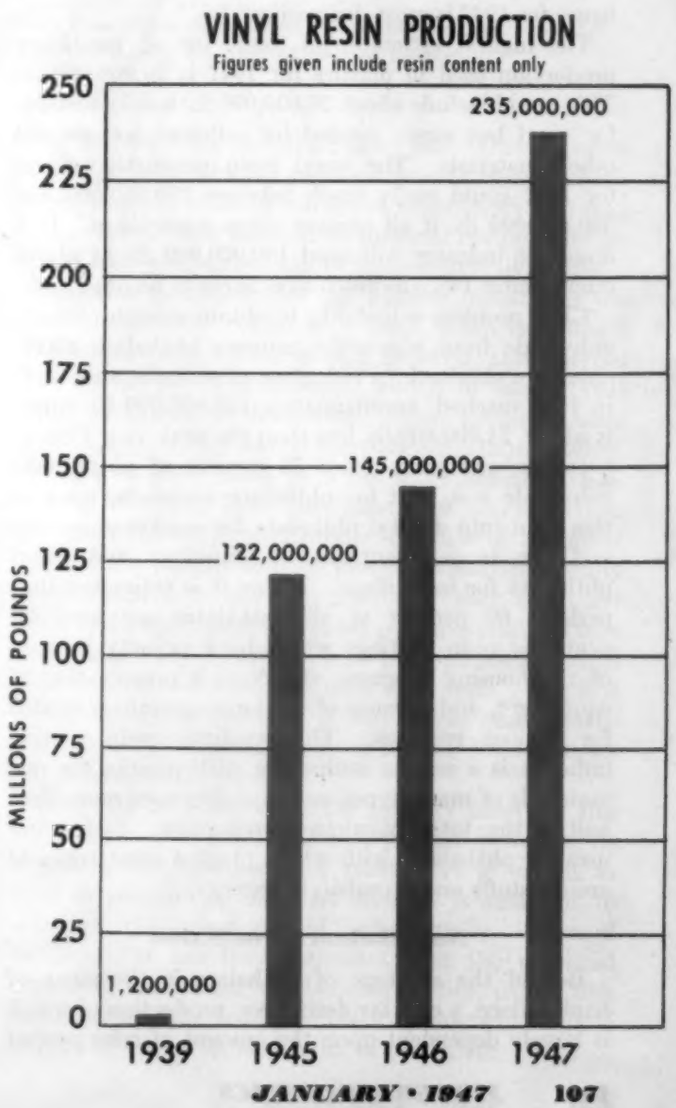
The vinyl family—It should be remembered that there are several members of the vinyl family including polyvinyl alcohol, polyvinyl acetate, polyvinyl butyral, polyvinyl formal, polyvinyl chloride and vinylidene chloride. The latter, made by Dow Chemical Co., is at present in small supply compared to vinyl chlorides but volume is rapidly increasing. Polyvinyl butyral is the type used with safety glass and has been widely used in fabric coating, particularly of the transparent type. Polyvinyl acetate has wide application as an adhesive and as a copolymer with vinyl chloride.

The new producers mentioned above are all primarily concerned with polyvinyl chloride or with copolymers of vinyl chloride. These are more widely used than the other vinyls. The outlets showing most promise at the moment are insulation material for wire coating, floor coverings, plasticized film and sheeting (unsupported), coated fabrics, surface or protective coatings for metal coats, priming coats, strippable film. It also has possibilities as molding powder particularly of the elastomeric type and is already being used at the rate of several pounds per car for automobile applications.

Other possibilities with wide potentialities are phonograph records, packaging film and various applications in the shoe field. Patent plastic for shoes and more particularly for women's handbags was in great vogue in 1946. None of the applications mentioned in this paragraph are as yet perfected, but there is every indication that they will be in the near future.

Perhaps the greatest problem confronting the industry has been a lack of plasticizer discussed on page 108.

Last 3 months of 1946 was estimated, as was total 1947 figure, on the basis that normal construction and operating procedure would not be disturbed by unforeseen circumstances. The 1947 estimate depends on how fast new producers and new facilities of old producers come into capacity production. If all planned facilities were completed in 1947 there would probably be capacity for production rate of between 250,000,000 and 330,000,000 lb. of resin, but there is little hope that full realization of plans will materialize. Furthermore it is quite unlikely there will be enough plasticizer to compound even 235,000,000 lb. of resin in 1947 and, consequently, producers may be slow in increasing output on big scale



Plasticizer shortage continues

AMONG the most serious of the materials shortages affecting plastics in 1946 and promising to be even more serious in 1947 is that of plasticizer. Vinyls are most seriously affected but the acetates, too, feel the pinch. The shortage is obvious when vinyl and plasticizer production figures are compared in Table V.

Table V.—Comparative Production Chart of Vinyl Resin and Plasticizers Used in Vinyl Compounding

Year	*Vinyl*	*Plasticizer*
	lb.	*lb.*
1945	122,000,000	48,000,000
1946	145,000,000	45,000,000
1947	235,000,000	55,000,000

Table V tells the story if the reader bears in mind the fact that from 30 to 40 percent plasticizer is required to properly plasticize vinyl resin for most applications. There was not enough plasticizer to do a proper job in 1945; consequently the estimated figure for 1947 is most distressing.

The highest estimate yet made for *all* plasticizer production used in plastics for 1947 is 70,000,000 lb. This would include about 20,000,000 lb. hardly suitable for vinyl but sorely needed for cellulose acetate and other materials. The vinyl resin production figure for 1947 could easily reach between 250,000,000 and 300,000,000 lb. if all present plans materialize. If it does, the industry will need 100,000,000 lb. of plasticizer, almost twice as much as is likely to be produced.

Chief problem is inability to obtain enough phthalic anhydride from which the primary phthalate plasticizers are obtained. Production of phthalic anhydride in 1946 reached approximately 100,000,000 lb. which is about 24,000,000 lb. less than the peak year 1944.

In the war years about 55 percent of all phthalic anhydride was used for phthalate materials, most of this went into dibutyl phthalate for smokeless powder and for large quantities of dimethyl and ethyl phthalate for insectifuge. Today it is estimated that perhaps 60 percent of all phthalates are used for synthetic resin coatings which have priority because of the housing program, the Navy's preservation of equipment, and because of the large quantities needed for various coatings. The synthetic resin coating industry is a serious competitor with plastics for raw materials of many types and probably uses more than half of the total plasticizer production. Still other uses for phthalates with which plastics must compete are dyestuffs and demulsifying agents.

Naphthalene production

Behind the shortage of phthalate is the story of naphthalene, a coal tar derivative, production of which is largely dependent upon the amount of coke needed by the steel industry. Production has increased from a pre-war figure of 100,000,000 lb. annually to around 300,000,000 lb., but the amount of naphthalene available for plastics was less in 1946 than in 1945. Greater quantities of naphthalene were diverted to moth repellents, insecticides, dyes, oil treating and tanning agents in 1946 than in the war years.

Only a small additional phthalic anhydride production is promised before late 1947. Two companies, it is reported, will build plants of 25,000,000 and 50,000,000 lb. capacity to make phthalic anhydride from ortho-xylol, a petroleum derivative. One plant is scheduled for completion about December 1947, the other for December 1948. Nearly all other producers are planning expansion but on a comparatively small scale.

The above reference to petroleum-derived phthalic anhydride is probably the beginning of a much closer association between plastics and the oil industry. At the present the Oronite Chemical Co. is producing a little under 10,000,000 lb. annually of phthalic anhydride from ortho-xylol but all of it is consumed by the Pacific Coast alkyd resin industry.

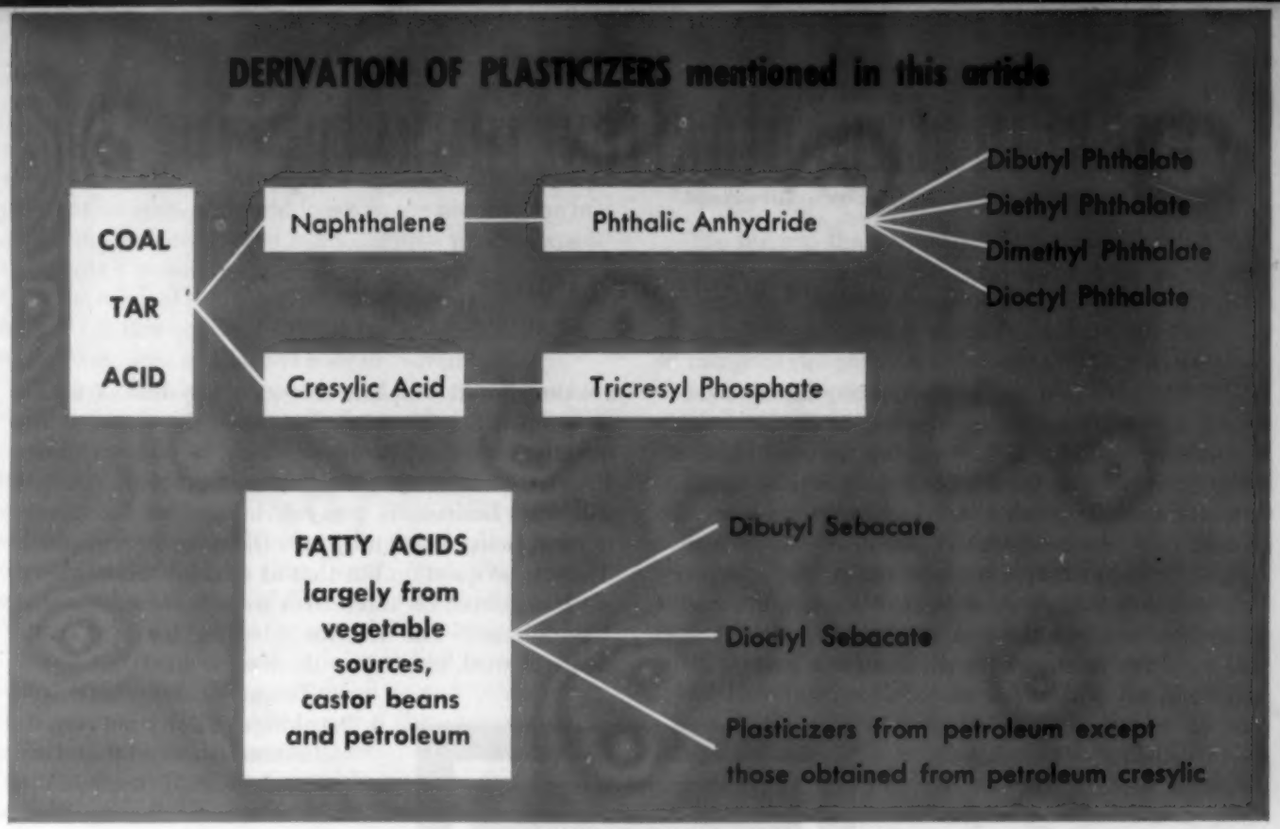
Phthalic anhydride and cresylic acid

The chief plasticizer derived from phthalic anhydride used by the vinyl industry is dioctyl phthalate produced at a rate of between 25,000,000 and 30,000,000 lb. a year. It is generally recognized as one of the most satisfactory all-purpose vinyl plasticizers known—it has particularly good high and low temperature resistance and is not susceptible to migration. But production is held down by lack of facilities and shortage of octyl alcohol as well as phthalic anhydride. Until this discrepancy can be remedied, almost certainly not in 1947, the industry will be handicapped.

The other phthalate plasticizers—dibutyl, diethyl and dimethyl (the last two used primarily for cellulosic plastics)—are also seriously affected by the lack of phthalic anhydride. Production in 1945 was less than 30,000,000 lb., there was no improvement in 1946 and there is a need for perhaps 20 percent more in 1947.

Another plasticizer in great demand for vinyl is tricresyl phosphate. It is particularly desirable in applications where flame retardant properties are essential, as in wire and cable insulation, and in coated fabric for upholstery in hotels and other public places. Production was approximately 18,000,000 lb., in 1945 and probably not over 12,000,000 in 1946. The 1947 production depends upon the availability of cresylic acid, another coal tar derivative.

Cresylic acid derived from petroleum is being used in substantial quantities for the manufacture of organic phosphate plasticizers but it is rather apparent that only slightly larger supplies of this type material are



This graph of the derivation of plasticizers includes only those mentioned in accompanying article. It is designed to do no more than to give the reader an idea of flow of materials

anticipated for 1947. There are other essential uses, requiring a large volume of material for special grades of tricresyl phosphate such as dust collectors for air filters and in hydraulic fluid.

Plasticizers from fats and oils

Of the many other plasticizers used in the plastics industry, most are derived from fats and oils, the chief source being the castor bean from which is derived dibutyl sebacate, the principal plasticizer for polyvinyl butyral in safety glass. Another material from the same source is dioctyl sebacate, a superior plasticizer for vinyl chloride and copolymers but limited to specialty applications because of its price—normally 65 cents but up to 90 cents at present. This compares with 35 to 40 cents for dioctyl phthalate.

Nearly all fatty acid plasticizers are of the secondary or specialty type and used in limited quantity. They are comparatively high in cost and a little more difficult to combine with resin. They have some advantages for low temperature flexibility but are not particularly desirable when the product in which they are used comes in contact with lacquered surfaces.

They, too, are scarce. Total volume in 1945 was 10,000,000 lb., dropping off over 10 percent in 1946. The raw materials needed for these plasticizers—vegetable oils and castor beans, for example—are extremely tight and will remain so for some time under present economic conditions. Petroleum companies have brought out several plasticizers of this type during the last year but they too are specialties and do not fill the need for an all-purpose job. One chemical company is developing an all-purpose fatty acid plasticizer which it believes will prove satisfactory and may announce in 1947, but neither material nor facilities for large-scale production will be immediately available.

Another possibility for the plastics industry is the nitrile synthetic rubber-type solid plasticizer which eliminates danger of migration. However, this material has not as yet been perfected and is at least a year away according to developers. Chief problems seem to be light stability and certain difficulties in processing.

Unfortunately there is a far more sinister consequence resulting from this plasticizer shortage than its effect on vinyl production. Because of the great demand for plastics articles, processors have frequently been tempted to use any plasticizer they could get and, as a result, have marketed poor materials. There is no longer any doubt that a properly plasticized vinyl film or sheet will meet the most rigid tests. But if it is improperly compounded it may crack, exude plasticizer or sweat, become sticky or brittle, develop many other disagreeable features.

Shortage of materials is the primary basis for this complaint. The plastics industry must convince its suppliers that the need for plasticizers is urgent as well as permanent and that demand is sufficient to warrant the provision of substantially increased facilities. It has been estimated that the potential consumer market for vinyl-coated fabrics, paper, film and sheeting alone is 400,000,000 lb. yearly which would require at least 130,000,000 lb. of plasticizer.

Trends in the plastics industry in 1947

by W. STUART LANDES*

IN AN America that still is experiencing rapid transition and war-born social change, to predict with confidence what will be in store for the plastics industry becomes an intolerable task of crystal gazing. Can anyone foretell what will happen to business in general over the next twelve months? Apparently neither the economists nor the politicians can interpret with accuracy today's mass psychology and, after all, public confidence or the lack of it pretty much determines whether or not we have a boom or a bust.

We can say with a fair degree of certainty that, relatively speaking, the plastics industry will fare about like other industries in the year ahead, with some factors modifying the degree to which we differ from the normal trend of affairs.

As president of the Plastic Materials Manufacturers Association, I have found it increasingly difficult to speak for the materials producers as a whole. Plastics materials and their uses are becoming too diversified. The technology and the attendant problems for one are quite different than for another. Therefore, all segments of the industry *may* not fare alike.

W. STUART LANDES

It is, however, possible to list some of the factors which will affect us and to evaluate them on the basis of the information now at hand. This I have done in the paragraphs which follow.

Prices assume major importance

For several years the shortage of plastic materials has been the number one problem of the industry and the bugaboo of molders and fabricators. In discussing this subject at the S.P.I. convention last April, I was accused of being somewhat pessimistic as to the immediate future. I see no reason to think differently today but, in my opinion, there are other potential problems ahead which may assume greater importance.

What are these problems and how will they be resolved? In the first place, now that controls are off, rising prices will, in the long run, automatically balance demand for materials with the supply. This development will supplant the seller's system of allocation which has been in effect since the war and frequently looked upon as arbitrary by the customer. Prices will constitute the foremost problem (as they will with business in general) because of the danger of overpricing which might set the stage for a recession. There is no question but that as a nation since the war we have bitten off more than we can chew. Or shall I say digest? The wish for things is greater than the desire to work to produce these same goods.

To my mind there is a striking similarity between the situation today and that which existed in 1920, the so-called silk-shirt era following World War I. Goods were scarce and prices were going up. Nearly everyone was hoarding inventories. Strikes had been rampant. Suddenly the bubble burst. Orders were canceled, employees were laid off, prices were cut, wages and salaries were reduced by many employers and inventory losses were written off. The adjustment, so-called, was followed by several years of prosperity.

The only difference between 1920 and today is that in the former case there had been no previous price controls and labor was mostly unorganized. The law of supply and demand will again regulate our economy. The question is—will we have a repetition of 1921 or can it be avoided?

Some reasons for price increases

To what extent will the plastics industry be immune from the factors that affect business in general? In the first place, we have had price increases and we can expect more, but the extent of these increases will probably be less than in many other products where labor plays a more important role. On the other hand, certain chemicals such as molasses, cotton linters, coal tar crudes, glycerine and castor oil are ordinarily sold to the highest bidders. Speculation has already modified the efforts of plastic material producers to keep prices at or below prewar levels.

As a case in point, the cellulosics depend largely on cotton linters as a raw materal. Prewar selling prices for cellulosic molding powder were based on raw lint at

* President, P.M.M.A. and vice-president of Celanese Corporation of America.

3 cents a pound. Early in November 1946 the price of raw lint was bid up to 9 cents before any of the holders elected to unload. After allowing for bleaching and purification costs and yield losses in the process, the increase in the basic cost of most cellulose plastics was 5 to 7 cents a pound. The 1946 cotton crop was smaller than the original estimates. Therefore, no relief can be looked for this season. In fact the only visible stores of lint were sold at 12 cents a lb. in November.

Diethyl phthalate is largely used as a plasticizer for cellulose acetate. It is made from ethyl alcohol and phthalic anhydride, the latter a coal tar product. By the end of November, alcohol had soared from an average of $53^1/_2$ cents per gallon to 86 cents. Phthalic anhydride increased 12 percent in price. As a result the diethyl phthalate price went from $20^1/_2$ cents a pound to an average of $28^1/_2$ cents a pound, equivalent to 2 cents a pound in the cost of the molding powder.

Since the producers of cellulosics had already absorbed substantial increases in labor and other costs there was no alternative but to pass these raw material price increases on to the customer. Similar examples (greater or less in degree) could be cited in the case of other plastics. The meteoric 300 percent rise in the price of glycerine has brought about a sharp upward revision in the price for alkyd resins. Ethyl alcohol, incidentally, is widely used in the manufacture of other plastics and chemicals. Except for the synthetic product, it is made from a variety of sources—molasses, corn, wheat, potatoes. It is doubtful if some of the marginal production would continue at much lower than the current price. At the time of this writing prices of some basic chemicals had not advanced. However, it is predicted that within a short time those that are able to hold the line will be in the minority.

The attitude of organized labor will, of course, be important. If we have more strikes prices are bound to go higher.

Generally speaking, I would expect those plastics that are closer to the prime source of raw material to rise in price less than some others. The older established plastics where there is less potentiality for technological advances will probably increase in price percentagewise to a greater degree than some of the newer ones. Temporarily at least these price increases are going to limit the market for certain plastics to a greater extent than for others. This may make it difficult for some well established businesses. With the return of real competition some companies strongly entrenched before the war will find their position weakened as a result of war-born competition, in or out of the plastics industry, which has heretofore not been apparent.

Competition between processors

As with business in general, I would look for an increase in the percentage of failures among molders and fabricators especially among those who started during the war on a shoestring and who will find it increasingly difficult to compete without the necessary background and experience and technical know-how. Some dislocation is bound to be brought about by the trend of some industrial users to do part or all their own molding.

Material expansion plans behind schedule

The big gap that still exists between fabricating and molding capacity and the available supply of plastic materials is likely to continue for a number of years. This will be narrowed to some extent by the writing off of marginal equipment which cannot produce at a profit. It is more and more apparent that planned increases in capacity for basic chemicals and plastics expected to be completed in 1947 will run well into 1948 or later.

I know of projects previously announced that are now temporarily shelved because of one or more of the following factors—lack of government approval, inability to obtain building materials or equipment, lack of assurance of adequate supplies of raw materials, insufficient financing due to rising costs, and dissatisfaction with present financing opportunities, as well as increased caution on the part of boards of directors. I know of still another case where operations have been postponed because a recent research discovery has indicated a more economical process. The program is further curtailed by shortage of trained technical men.

It is my personal belief that the delays in expansion will not be the bottleneck. Some of the facilities for producing plastic materials did not operate at capacity in 1946 because of strikes in other industries, notably in coal and steel. It looks as though 1947 may witness a similar situation. By the same token, some of the recent strikes in certain plastic materials plants probably have not reduced the overall supply of such plastics to the extent indicated.

Attitude of consumer affects industry

Among other trends to be expected in the industry in 1947 should be increased consumer resistance to inferior goods and misapplications. I think we shall see a considerable advance in the education of those responsible for buying plastic products. This may result in a demand for either informative labeling or outside laboratory approval for certain applications. At any rate, the industry should begin to police these evils as a measure of self-protection rather than just talk about the subject as we have been doing for the last two years.

The natural tendency will be for everyone to want more for his money. Companies will expect salesmen really to sell their products. Unnecessary frills will be eliminated. Budgets will be cut wherever possible. The same goes for unintelligent advertising. In the plants and laboratories great attention will be paid to technological improvements and labor efficiency. The fear of foreign competition seems to be overemphasized.

Lest anyone draw the wrong conclusion, let me assure them that I am optimistic for the long pull. I am also among those who believe that our system of free enterprise coupled with our natural resources will keep this country in the van of progress. As for plastics—a steady growth rather than a spectacular one will be far better in the long run.

LAMINATES take over

ALL PHOTOS COURTESY BAKELITE CORP.

1—Inside panels of decorative high strength paper laminated to phenolic resin impregnated alpha cellulose core are a new development in automotive field. They are presently to be found in a new station wagon type car where they have proved very sturdy

2—A view through the open rear deck of this car shows how the laminated material is used as a facing for the rear deck, for 2 door panels, 2 quarter sections and a between-door stripping

interior paneling in postwar automobile

Hard wear and good appearance characterize these laminates which comprise a heavy phenolic resin impregnated alpha cellulose paper core faced with high strength paper

FOR the first time, a plastic laminate is being produced for the major portion of the inside of an automobile. The car is the new De Soto station wagon. Instead of the traditional wooden construction, which has so long been associated with the station wagon type of car, decorative grain effects are reproduced on sections of high strength paper which, in turn, are laminated to a core of heavy phenolic resin impregnated alpha cellulose paper. The sandwich is finished on the back with a second skin, or sheet, of undecorated high strength paper.

In this car, four laminated door panels, two rear quarter panels, one rear deck and two strips mounted between the doors comprise the entire inside surfacing. In the doors, three tones are used in the paneling. The rear deck and quarter panels are formed to exact shape while the automobile door panels are flat sheets, die cut to the desired size.

A tested product

Having withstood many months of rigorous testing, which included weathering, fading, abrasion and downright maltreatment, this plastic structure has proved that it can take it. Mounted in test cars side by side with the traditional materials, the laminates have come through with little, if any, signs of wear or scratching while the traditional materials have become scuffed, worn and generally unusable. The fact that the material is being given its first application in a station wagon, which is used as both a passenger car and a truck, is proof that these materials will stand up under the most adverse conditions.

Less spectacular, but equally significant, is the second automobile interior section being made of this decorative sandwich structure—a garnish molding for the rear of the front seat.

Production at Briggs Mfg. Co., of Detroit, Mich., the company responsible for this development, is meeting the requirements of the De Soto station wagon assembly line. This volume is a small percentage of total automobile production. If, however, this method of producing decorative laminates for car interiors should ever get going on a mass production scale, it will not only produce a better car but will carry out the tradition of American mass production of a better object at a lower price with longer wearing qualities and improved appearance.

This development makes plastics a material of major importance in the automotive field. It gets by the idea of sheer decoration and places plastics along with wood, steel and all the other traditional materials. And not only do these laminates do a better job, but they are produced at a cheaper price than traditional interior paneling materials.

Cheap and sturdy

The cost of resins and fillers was, until lately, one of the principal stumbling blocks to the commercial production of these laminates. Speed of production was another. When, four years ago, Mr. Al Prance of the Briggs Mfg. Co. undertook development of these materials, he found that satisfactory results could be obtained very easily on an experimental scale. But time and effort were needed to bring production to today's speed which will more than keep a standard assembly line in operation.

Each of the two present applications of these lami-

3—Another view of the car interior shows the rich wood grain effects printed on paper surfacing

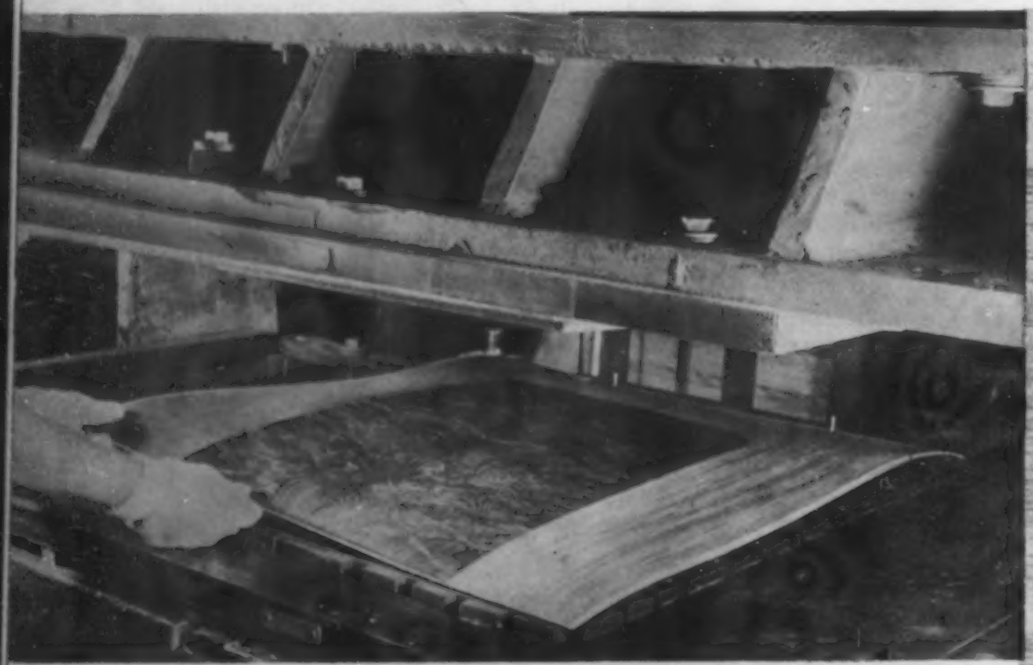
nates—the interior paneling of the De Soto station wagon and the dashboard and garnish molding on the rear of the front seat of another make car—is produced by a distinctly different method. In fact, one might say that there are two classes of laminates. For the De Soto parts a hot forming method is employed; for the dashboard and garnish molding a process very similar to that used for molded laminates is followed. Both processes use the same type of sandwich, however, and the same resins and fillers.

Hot forming process

The first step in this method of processing is the layup of the impregnated paper sandwich. This sandwich, composed of heavy alpha cellulose paper as a core, is covered with a skin of impregnated high strength paper—plain colored for the back surface, which will not be exposed, but printed by standard rotogravure methods for the surface which shows. Any design in any combination of colors can be achieved in the outer decorative sheet inasmuch as a transparent phenolic resin is used on the exposed surface side of the sandwich construction.

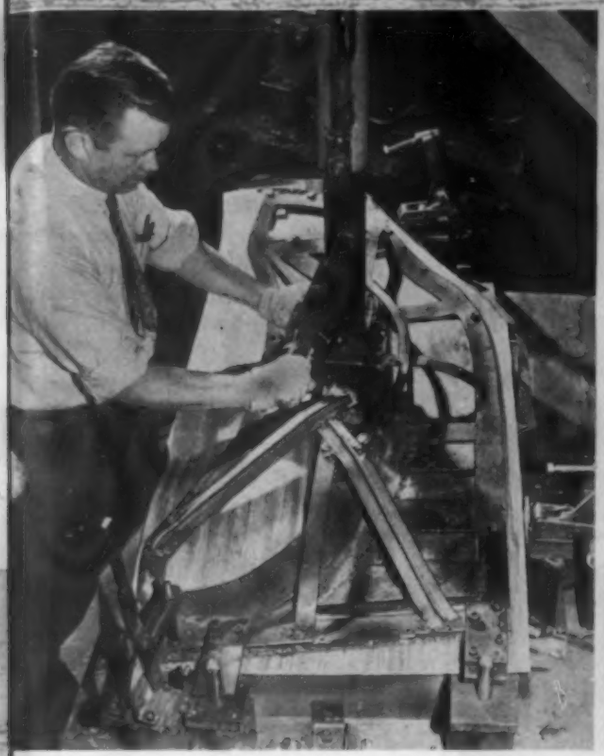
In the new De Soto station wagon, the effect is that of wood grain, the authenticity of the graining being assured by the fact that actual wood grain was the copy for the printing plates. Variation is achieved by the use of two colors and two grains of paper in the door paneling, as compared to the single sheet of grained paper in the rear quarter panels, rear deck and between the door strips.

With the core laid up, the phenolic resin impregnated high strength printed paper is cut to shape and placed in position on the sandwich. This requires care when sheets with different graining are used in the same assembly. The entire sandwich is then placed in a



4—An operator places a laminated panel in trim press. The piece has come from an infrared heat chamber where it was heated to proper temperature for this next operation

5—Here the panel is seen after it has been trimmed and punched with holes for mounting metal trim and window regulator shaft. This trimming and stamping is completed in 1 operation. The precision with which the piece is cut almost eliminates necessity of further finishing



6—(Left) Rear quarter panel is placed in a forming fixture and pressure applied. Fixture serves as a template for drilling holes and applying markings for subsequent band saw operations. 7—(Right) Same panel before removal from fixture shows contours that can be attained this way

laminating press and cured at a temperature of about 350° F. for 1½ minutes. The cured laminate is taken from the press and held flat by a wooden form until it is cooled. This procedure during cooling is necessary because the laminate is unbalanced and would warp if it were not held flat.

Curing and cooling completed, the panels are reheated by a bank of infrared lamps to approximately 300° F. The time cycle on this infrared heating is accurately controlled by an automatic time switch. As this switch cuts off the infrared lamps, the preheated sheet is moved to position in the stamping die and another sheet is put in preheater. The die cutting of these laminates is very similar to a stamping operation and the speed of the operation is the same. In the case of the interior station wagon panels the cutting of these pieces is done in a crank press.

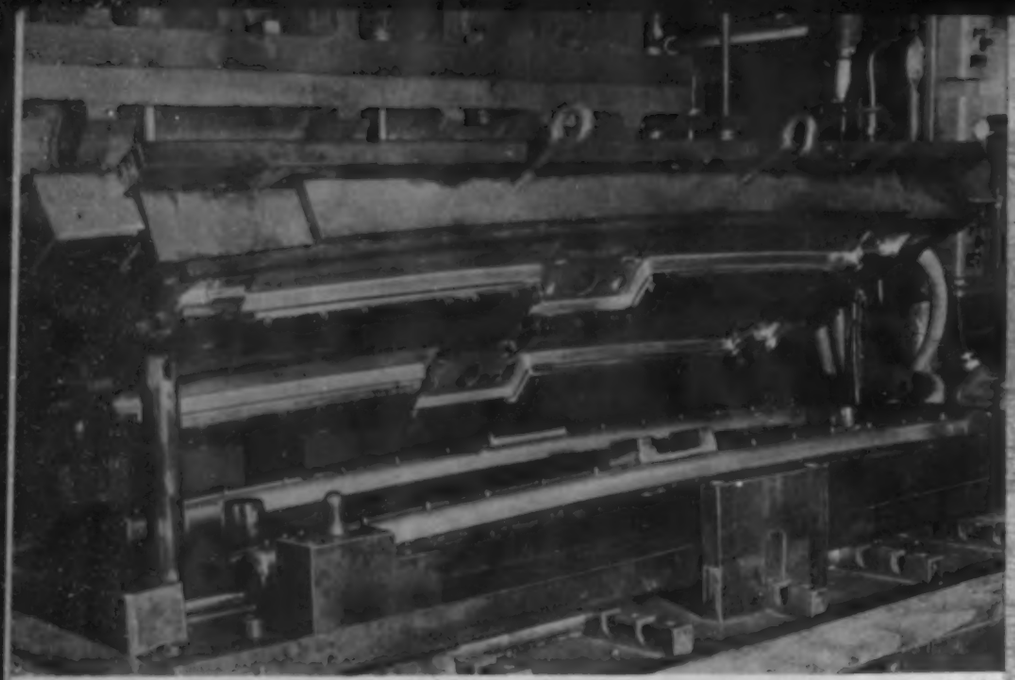
In Fig. 4, the operator has placed a preheated sheet of the cured laminate in position on a steel rule die. The rubber knockouts can be seen on both sides of the rule. Figure 5 shows the panel immediately after the stamping operation, with the operator removing the stamped part from the press. The clean cut achieved in this operation practically eliminates further finishing work. As can be seen, holes for mounting the metal trims as well as a larger hole for the window regulator shaft were all punched in the one operation.

Production of the panels for the rear deck and the rear quarter section is not as simple since these parts must be formed to shape. The die cutting of the material is the same, however, as for the flat panels. When they are to be formed, the hot sheets are taken directly from the die cutting operation and, while still hot, are placed in a simple forming die.

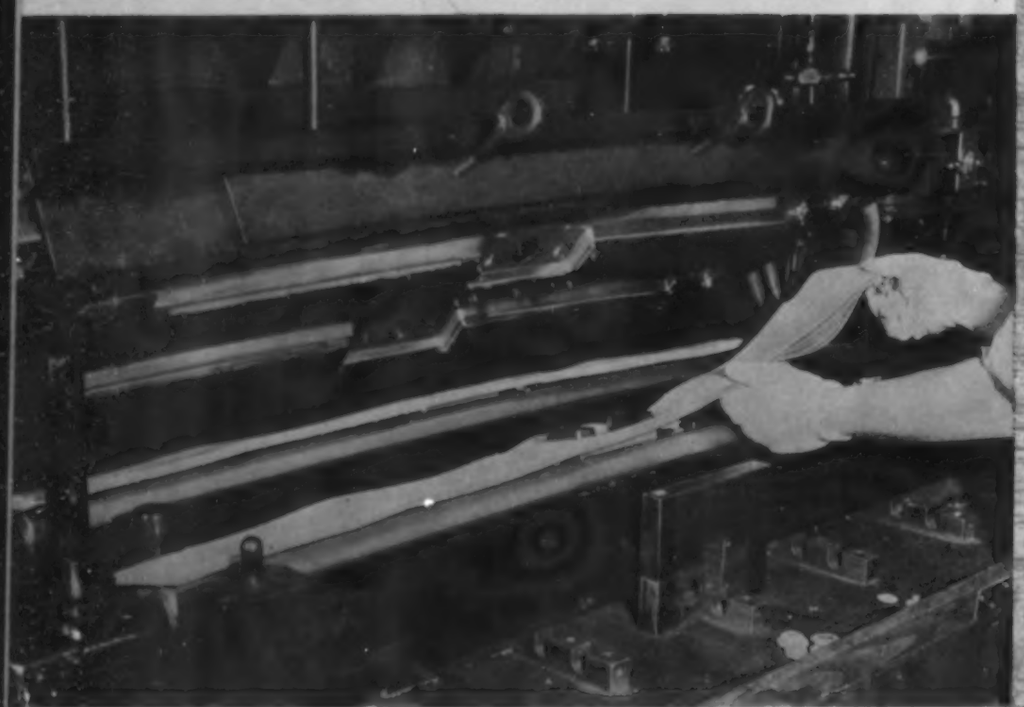
Fig. 6 shows the setup of a forming die just after it has been clamped in the closed position. The die cut heated laminate has been placed on a wooden male form which makes up the lower half of this die. The upper portion of the die is merely a skeleton framework which presses on the laminate at certain strategic points to make it accurately take the required form. Figure 7 shows this forming jig in the open position with the operator removing a formed panel which, after a few further operations such as the drilling of assembly holes, will become the rear quarter in a station wagon.

The forming dies used to shape these laminates are generally produced from wood at a very low cost. For one particular formed part the actual money outlay for mold was estimated at 250 dollars. This figure included the cost of the material and the time consumed in the production of the die.

The savings are most evident when comparison is made between the cost of these forming dies and the cost of metal dies for the same parts. Take as an example a



8—Garnish moldings used to trim sedan are formed in this 2-cavity mold shown in open position. Dies, hinged at the rear, are raised, lowered and fed into this hydraulic press by use of air pressure



9—Five sheets of impregnated paper for making garnish trim are being placed in 1 of the dies. Brass inserts for use in fastening moldings to car body are put in die before resin impregnated paper is molded

job currently under test which comprises two left hand and two right hand panels, calling for four different molds. Using the hot forming process the forms cost about 1000 dollars. If dies had been made of steel, it is estimated that each die would have cost in the neighborhood of 20,000 dollars, making total die outlay 80,000 dollars for the four molds.

Molded Laminates

Steel molds are, however, required in the second method of processing these laminates—the method which is similar to that used in the familiar molded laminate, and which the Briggs Mfg. Co. employs for such parts as a complete dashboard assembly or garnish molding. But these steel molds are still not as expensive as metal stamping dies and the parts, when they come from the mold, require only nominal finishing, their surface appearance and texture already having been molded in.

The same type of sandwich is used as for the interior paneling of the station wagon, but it is used differently. Each mold charge of phenolic resin impregnated paper is first die cut to size, then loaded in the mold and molded in a manner very similar to that used for what the plastics industry knows as molded laminates. There is one difference, and a very important difference. The cure is completed in 90 seconds.

Perhaps the most unique feature in the mold setup for these dashboard assemblies and garnish moldings is the mold itself which was devised by Briggs tool and die

experts. The mold has a tilting top and, in operation resembles somewhat a phonograph record press. But, whereas in the molding of phonograph records a tilting head press is used with the upper stamper fastened to this tilting head, the mold for these laminated parts is not fastened in the press at any point and, in operation, it is withdrawn from the press after each cycle. Obviously, the mechanical requirements for tilting the head of a press big enough for a piece of this size (46 in. in length) was out of the question. A tilting head mold was found to be the solution—achieved by hinging the mold at the back. This method of mold construction made possible the use of a very short travel on the main ram of the hydraulic press.

Figure 8 shows this tilting head mold retracted from the press and held in the open position by the two vertical steel rods seen at the right and left of this picture. These rods are operated with a vertical motion by two pneumatic cylinders.

After curing time for a garnish molding has been completed, the lower platen of the press drops a matter of 2 in. which is just enough to remove the clamping pressure on the mold. Two pneumatic cylinders, which in this case operate rams with a horizontal motion, push the mold (still closed) out of the press. Traveling on rollers, the mold comes to a stop in the position shown in Fig. 8. In this location, openings in lower portion of the mold for the garnish moldings are directly above the two mold-opening hydraulic plungers which, actuated by air pressure, push open the tilting head of the mold. In this position there is ample clearance between the two mold halves to permit the removal of the molded parts and the reloading of the molds with a new charge preparatory to the next cycle.

Setting up the inserts

In the case of the garnish moldings, threaded brass inserts are molded directly into the piece. Inserts with large heads are used so that die cut washers of the impregnated paper when placed over the inserts are held in position by the head. With the laminated washers in position, the brass inserts are located in holes in the male portion of the mold, the holes being the same diameter as the outside diameter of the brass insert. As the parts are molded, the impregnated paper washers become firmly bonded to the main body of the part. This does away with subsequent drilling operations which would otherwise be necessary to permit the assembly of this garnish molding in the car using the familiar screws that extend through to cover strip.

Figure 9 shows the operator completing the loading of the second cavity of this mold with five layers of die cut phenolic impregnated alpha cellulose paper. The inserts have already been placed in position. The layup complete, the vertical acting plungers retract, lowering the upper portion of the mold until it is in contact with the new charge. The horizontal plungers push the mold back into press and molding operation is repeated.

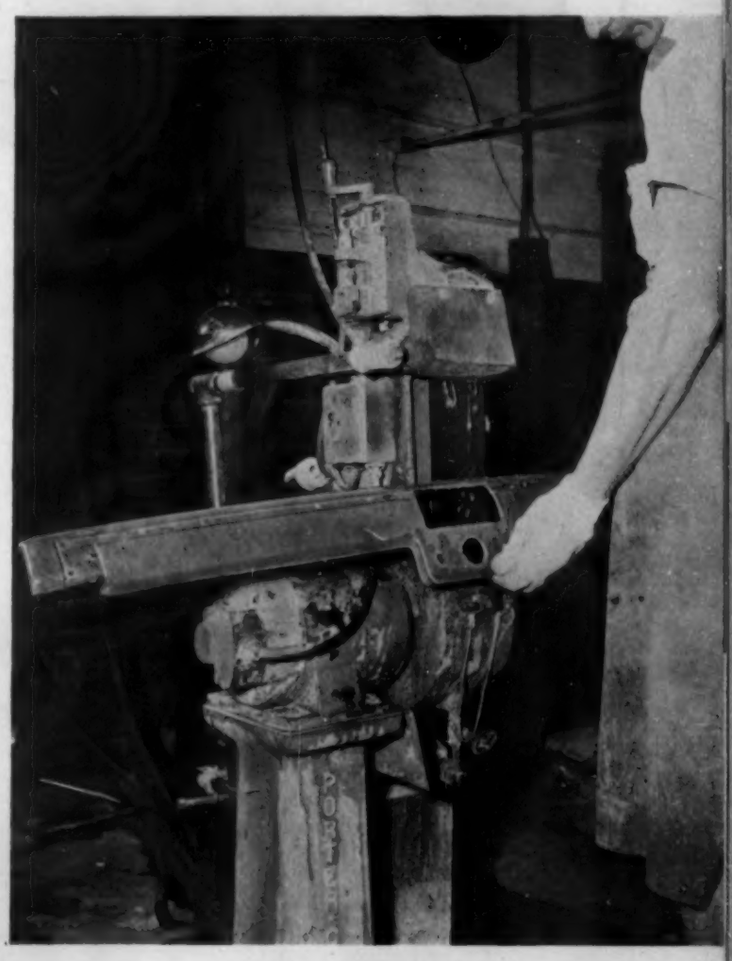
Movement of the mold and press as well as the timing of all portions of the molding cycle including the preheating is completely automatic, merely requiring the operator to press a button for the start of the cycle. To expedite the cure of this material and to dry off any undesirable moisture which may have been picked up by the paper, each charge of material is preheated by infrared lamps.

Plans for the future

At the moment, these operations are being carried out in what is the plastics laboratory of the Briggs Mfg. Co. However, the operations cannot be classed as laboratory because they have been set up on a production basis. Equipment similar to that now in operation is being installed in one of the large production plants of this company and, in a very short time, these laminated automobile panels will be coming off the line in this new location, with no change in equipment, methods or technique. As a matter of fact, even the operators will be transferred to the new location.

And as fast as these production jobs are removed from the laboratory the company plans to initiate new projects, develop improved production methods, train new

10—*The sedan garnish molding, taken from the forming machine, is wet-sanded to remove the flash that is left on this piece*

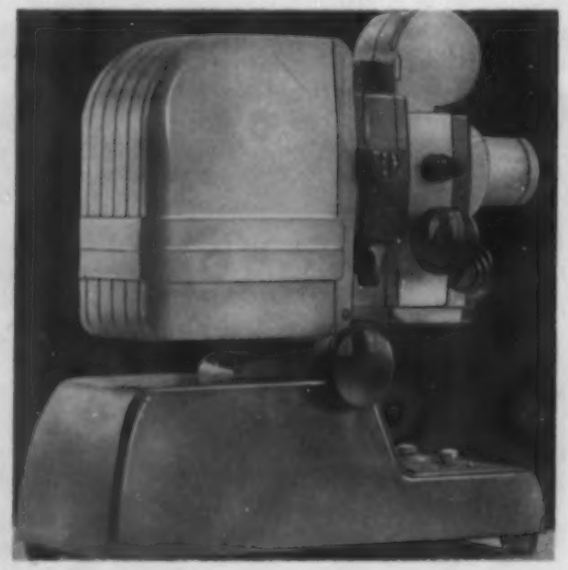


men, repeating the procedure when the experimental work reaches the production stage. At this stage the work is ready to be moved to the production section of the plant.

A new field is opened

The beauty and richness obtainable with this laminate are vividly shown in Fig. 3 where two types of wood graining and a leather reproduction for the kick panel are employed. It was difficult to photograph the inside of this car in a way that would bring out the qualities of the material. To show the entire inside of the car, it was necessary to take a photograph without the seats installed. This photograph (Fig. 2) includes all five of the different parts which are used for the inside paneling of this car—deck lid, 2 door panels, the center panel between the doors and the rear quarter panel of the car.

It takes little imagination to visualize many other applications for this type of material. Because of the unlimited color range and design possibilities, there is little question but what this development will become of great importance, not only to the automotive industry but to any industry which requires strength, durability and beauty in the material it uses in the production of all of its products.



PLASTICS HAS MUCH TO OFFER THE photographic field—durability, inherent color, light weight, formability. All these qualities have been put to good account in a film strip projector—for use with 35-mm. film or lantern slides—designed by Richard Lonsdale-Hands & His Associates, London, England, for Gaumont British Film Corporation.

Urea formaldehyde is used for the lamphouse casing, the top spool box and the film conveyor. The controls and knobs are molded of phenol formaldehyde. The lower film spool is formed of Perspex, a British manufactured acrylic. The transparency of the latter material allows the operator to view the film at all times and estimate the amount that has been run off. All the other parts of the projector are of aluminum.

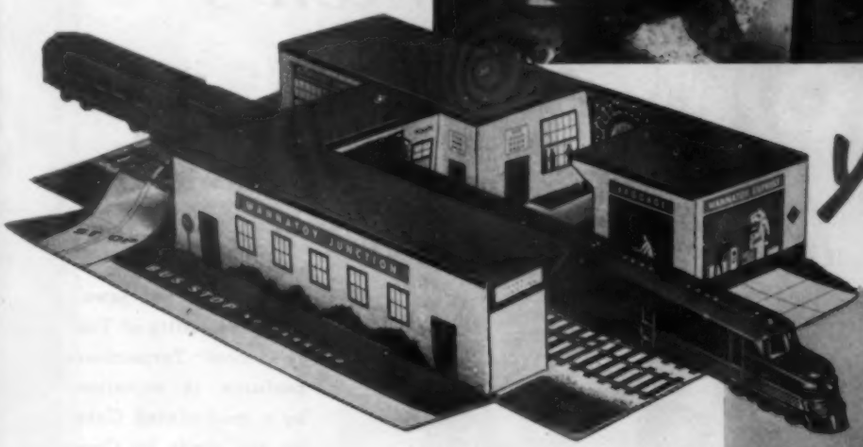
To avoid complications in matching colors for all Gaumont film equipment and to give continuity to the merchandising program, three standard colors are used. Urea parts are white, phenol parts are maroon and metal parts are buff colored.

A CARRYING HANDLE, WHICH DROPS down out of sight when not in use and preserves the streamlined appearance of the radio, highlights the 1947 Scottie portable put out by the Remler Co., Ltd., San Francisco 10, Calif. The cabinet of the completely enclosed and dustproof radio comprises six molded parts. The top, front, ends and bottom are one piece. The back is molded separately and screwed on, the screw holes being metal inserts molded into the cabinet. Also a separate piece, the handle is molded with metal posts which support it and drop down when the handle is not in use. All these parts and the knobs are molded of Plaskon by the radio company's Plastic Division. The large readable dial tunes stations by name and its position makes it easy to tune while standing or seated. It is molded of Lustron and is assembled by a tongue and groove arrangement. White numerals and colored markings cannot rub off for they are molded in on underside of dial and light up with a jewel-like effect against the dark background.

Plastics Products

Plastic place mats with nursery rhymes printed on the reverse side of the rigid Vinylite sheets amuse the children. Easy to clean, they please mother, too. G. Felsenthal & Sons, Inc., makes ➡

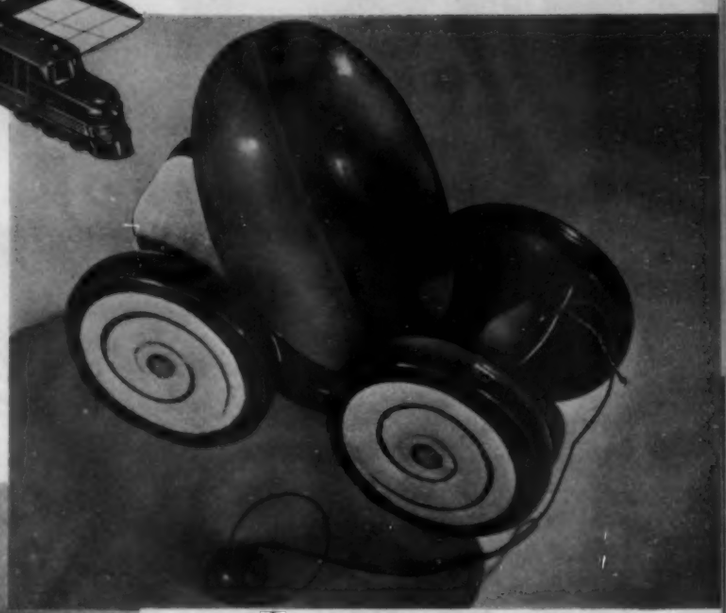
Clear the way for this toy train molded of Nixon ethyl cellulose. Dillon-Beck Mfg. Co. molds the set—an engine, two Pullmans and one observation train being turned out at each molding shot ⬇



young life

To facilitate inquiries, addresses of companies mentioned on these pages are listed on page 200

Baby can sling hash any time with this boilable Melmac training tray. Of a sanitary white, it fits any chair. Ackerman Plastic Molding molds for Stout-Lindsay, Inc. ⬇



⬆

Toddlin' tots will be delighted with this Tuffy Tumbler. Vivid colored floater rumbles and tumbles as toy is pulled. Tuffy Toys, distributor and manufacturer, injection molds floater of cellulose acetate. The base is aluminum; the wheels are wood

Women's Accessories

A glamorous adaptation of the long-handled scrubbing brush is this Helena Rubinstein "Puf-Puf." Injection Molding Corp. molds the ivory-colored handle, cover and holding ring of Lustron. Puffs come in blue and pink

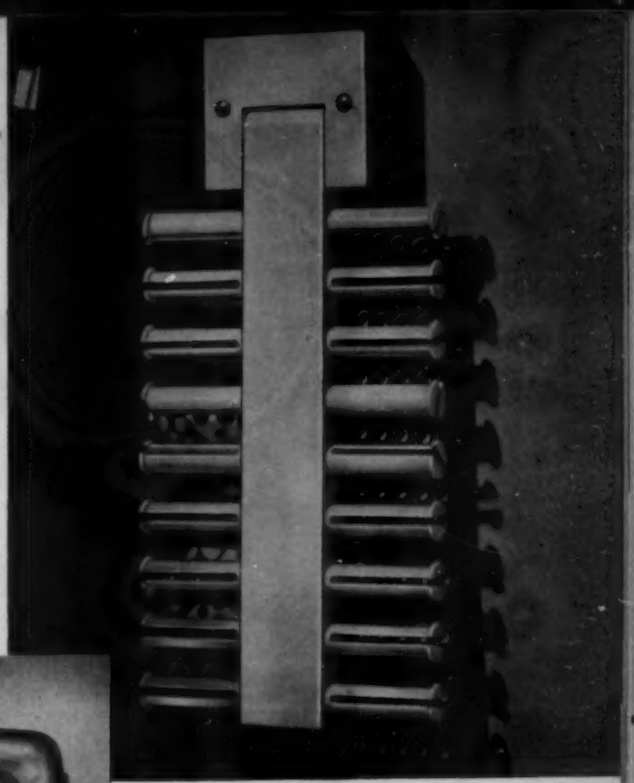
The simple yet jewel-like personality of Tussy's new Terpsichore perfume is enhanced by a gold-plated Catalin top made by Crystal Products Co. A glass stopper extending into the base of the cap insures a perfect seal and combines with plastic for light weight

Hats and handbags, the nucleus of costume accessories, have added appeal when matched. Here, a set fashioned from Plexon is designed in black and gold to enhance the elegance of the cocktail hour. Because the plastic coated yarn stays crisp and fresh in all weather, it has an extra appeal for the ladies

The cluttered feminine handbag is outwitted by this Tenite and Chemaco cellulose acetate "Keymate," molded by Berens Plastics Corp. A bronze lifetime spring holds keys firmly in place, and a pin at the back attaches "Keymate" to purse or pocket lining

FOR THE MEN

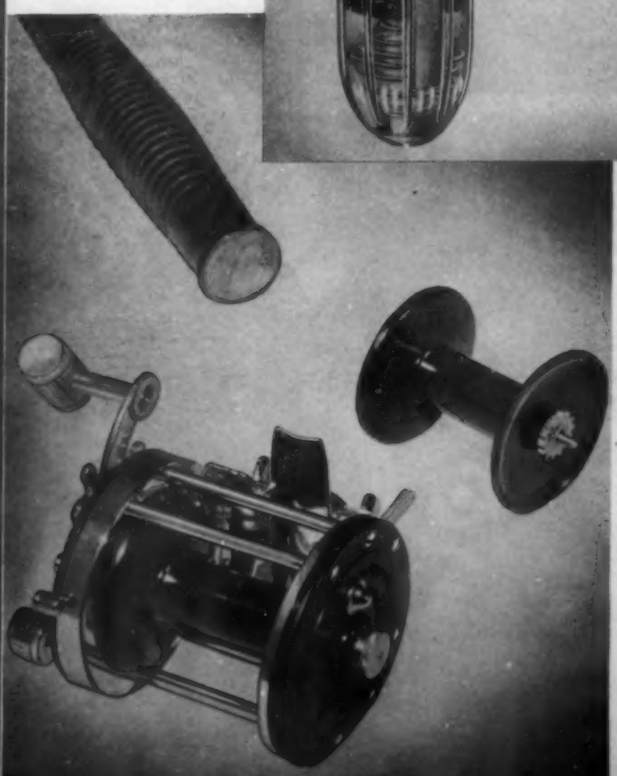
A flip and the tie rack is up ready for quick tie selection. Rack is injection molded of polystyrene and Tenite II by John Mack & Son Molded Products Co. Slots in 9 double pegs are molded by means of replaceable inserts in mold. Two-piece support is cemented—3 studs on 1 part fitting into bosses on opposite part



For the man who smokes a pipe—10 feet of pipe cleaner, compactly wound up in a dark Styron case. Plas-Tex Corp. injection molds 2-part case for NuPak Pipe Cleaner Co.

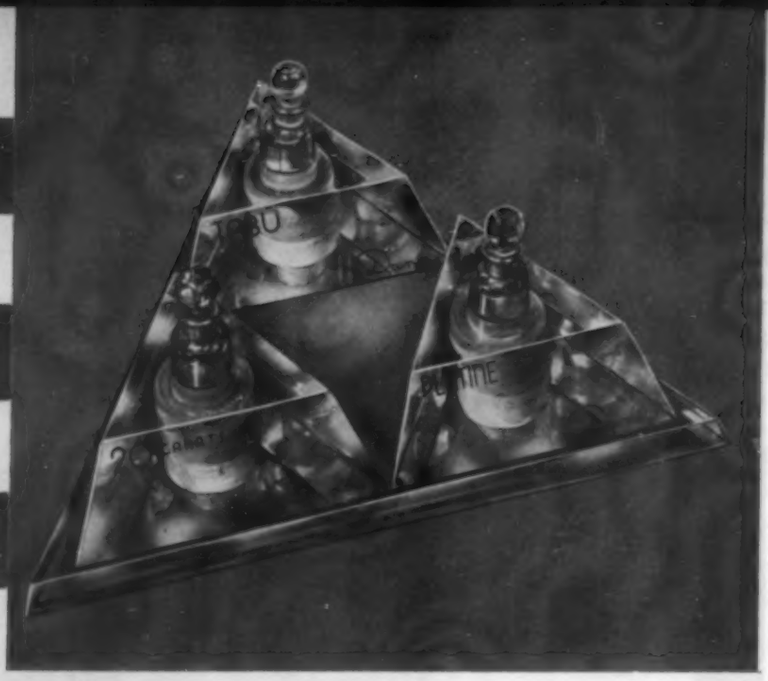
The addresses of companies mentioned on these 8 pages are listed on page 200

On the beam—a flashlight that can stand tough handling without damage to batteries, bulbs and working parts. The transparent Ethocel case displays batteries so that any corrosion can be detected at once. Gits Molding Corp. injection molds the case in 8 gay colors



The surf fisherman's bugaboo—salt water corrosion—is reduced in the Surfmaster casting reel manufactured by the Penn Fishing Tackle Mfg. Co. through the use of plastics. The molded Resinox spools and end caps also keep the line from coming into contact with the metal

BUSINESS AND INDUSTRY

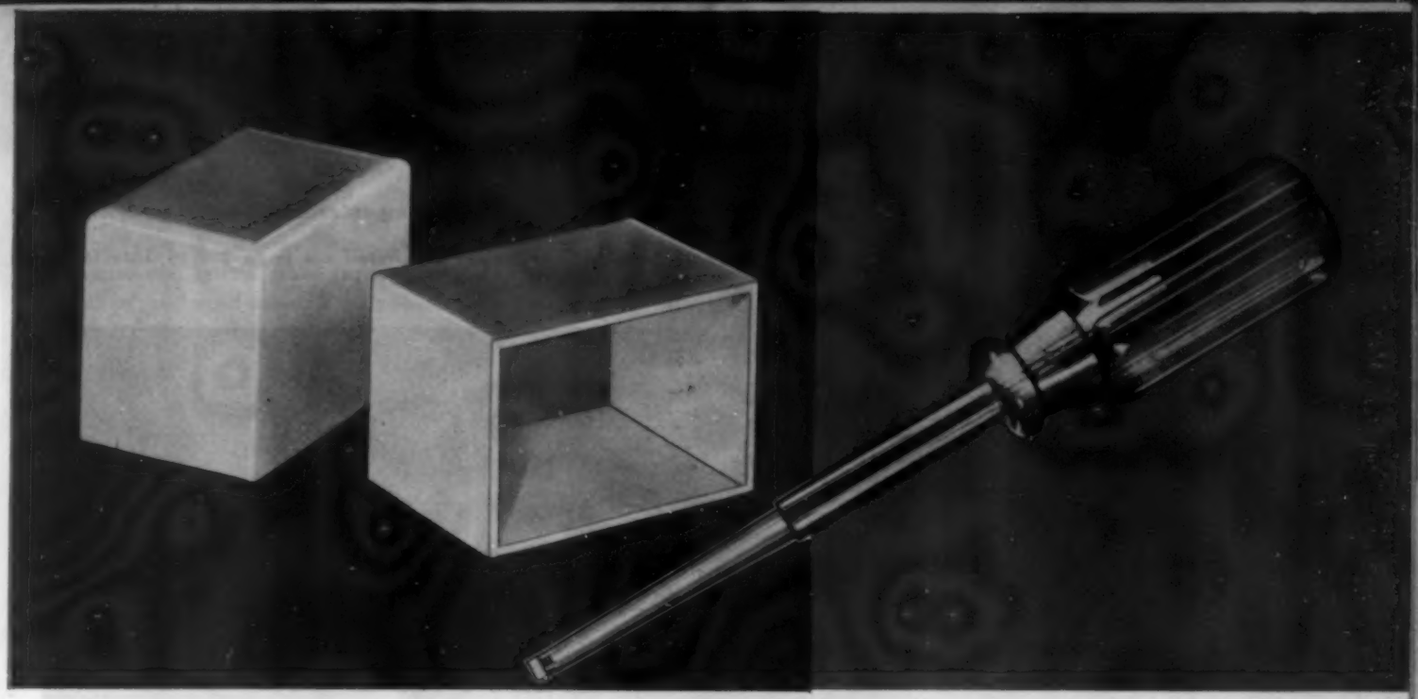


An all-plastic perfume tester with gem-like radiance has been created by Charles Victor Co., Inc., for Dana Perfumes. Design of the display is based on triangular motif—bottles are locked in heavy, and light-reflecting Lucite blocks

Mothers and babies, tired and mussed from travel, need not spare use of the comfortable furniture in New York's Pennsylvania Railroad station. The upholstery is moisture and stainproof Velon, which can be very quickly and easily cleaned with a damp cloth

Good to the last drop! And in this case even the last drop won't harm labels laminated between sheets of Lumarith film by Shellmar Products Co. Printed surfaces retain true color and are protected from dust, fingerprints and liquid stains by this gloss-finish transparent film

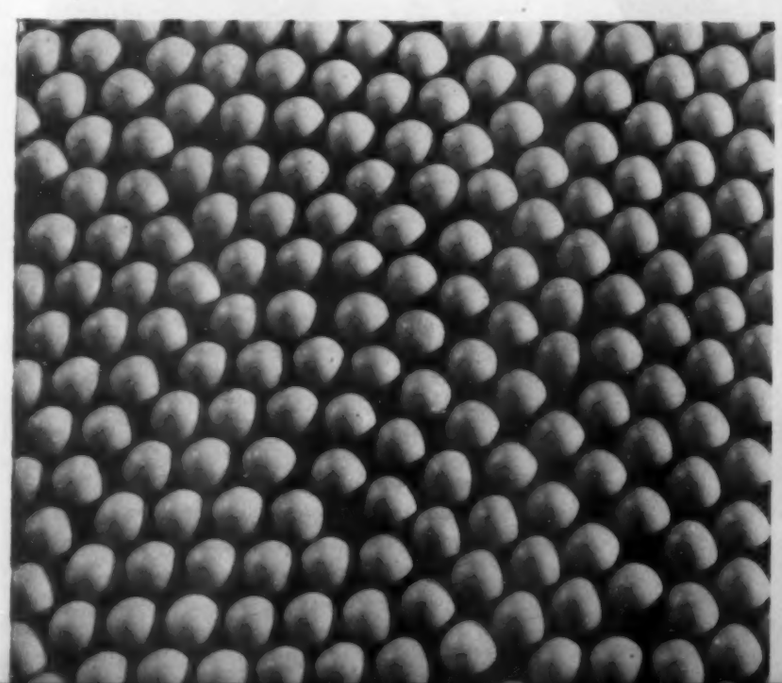
Addresses of all the companies which are mentioned on these eight Plastics Products pages are listed on page 200 of this issue



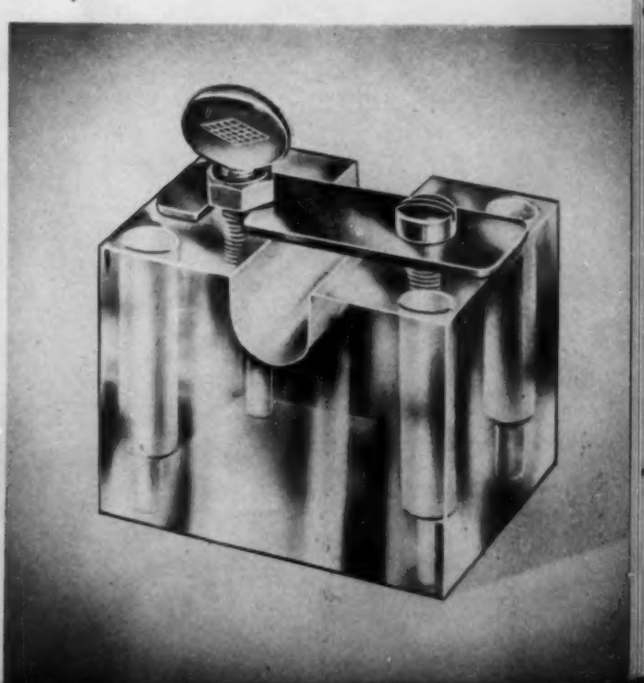
These special dust and moisture protection covers for aircraft electrical relays were manufactured by Master Plastics, Inc., using polyester-type contact pressure resins reinforced with Fiberglas milled fibers. The Synvar polyester resins, when combined with the glass fibers $^1/_8$ in. long, gave the required mechanical characteristics as well as temperature resistance of more than 300° F. The covers are nonconducting, have good dimensional stability

One of the first developments of nylon as a material for producing insulated alignment tools is this screw driver with a nylon shaft. Developed by a leading manufacturer of electronic equipment it suggests the applicability of this type of tool in allied industries. The handle is of cellulose acetate butyrate

Light in weight, strong and weather-resistant, these ball bearings are used on gun turrets of United States Army aircraft and meet necessary close dimensional tolerances. Of Bakelite cast resin, these ball bearings must be able to resist shock in temperatures which range from —60 to +180° F. Three different companies—the Amdur Redlich Corp., the Mastercraft Plastics Co., Inc., and the Hartford Steel Ball Co. — fabricate the ball bearings for Emerson Electric Co.



For marine and mobile radio transmitters and receivers using the vertical whip-type antennas, Printloid, Inc., has introduced a clear transparent acrylic supporting insulator. The support has a brass strip with wing-nut that swings open readily, allowing antenna to be lowered when passing under a bridge or under other overhead obstructions

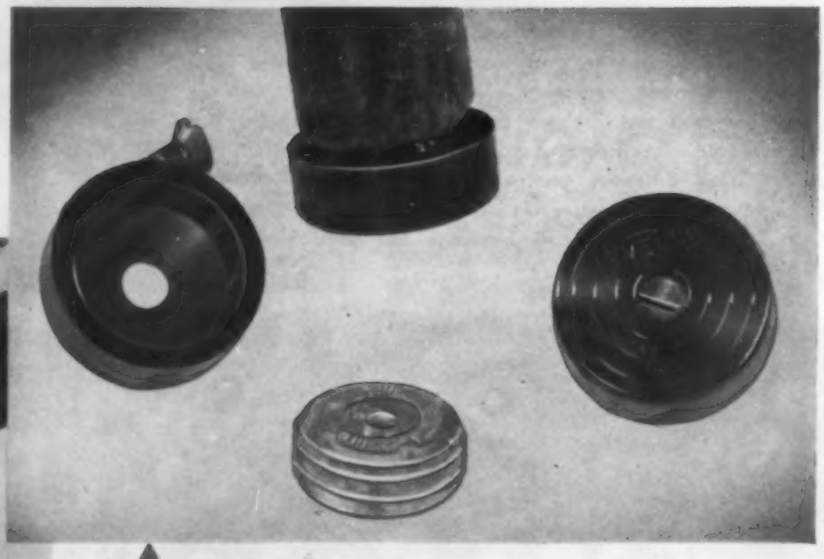


PLASTICS SIMPLIFY

Addresses of all the companies which are mentioned on these eight pages are listed on page 200 of this issue

Tickling the ivories is not a reality on this piano with keys made of Nitron. Advantages over ivory keys are: resistance to cracking and discoloration, ease of matching and elimination of lip overhang. Pratt, Read & Co. form keys in 1 piece

"Revolutionary" is the word for bowls made by Tupper Plastics, Inc., of their Poly-T material. The polyethylene bowls may be flexed for easy pouring or to loosen sticking food. Non-toxic, tasteless, impervious to freezing, bowls are handy for the refrigerator, kitchen or table



For that wobbly chair or table. Levelor Corporation's castor is molded of Tenite II in 3 parts—plug, bushing and cap. Pressure levels the castor and locks it in proper position

Two gaily colored items are being molded of Loalin by Sterling Plastics Co. The liquor pourer comprises 2 molded parts; sharpener is precision built so lead becomes needle sharp

YOUR LIVING . . .

They're bright—and fabric—but these shower and window curtains for the bathroom resist water and stains, hold their color and withstand prolonged wear. That's because they are protected by a super-thin layer of Monsanto's transparent, flexible vinyl butyral plastic

Smoother, quicker shaves with same electric shaver are possible with the Electronic Specialty Co.'s Ranger Inverter which changes AC to DC. The 2-piece housing is molded by Rheinhold-Geiger Plastics of ivory-colored urea

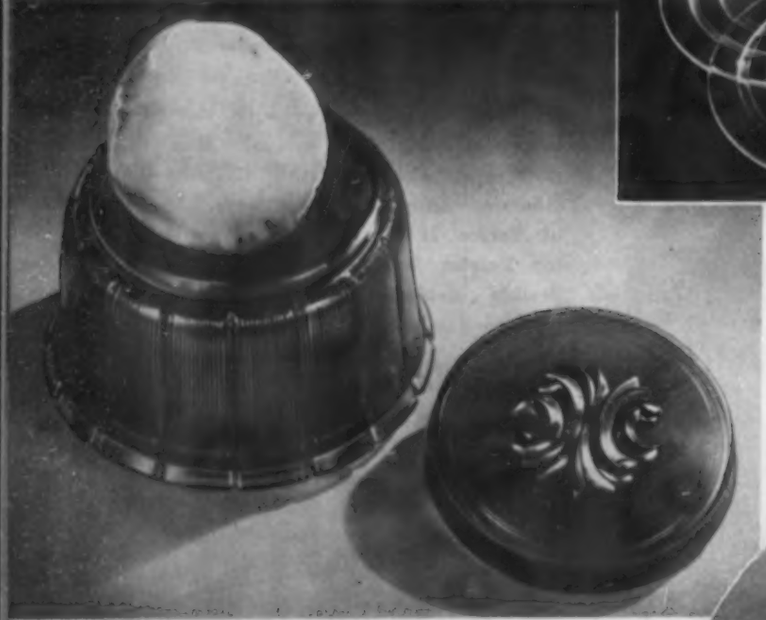
Exasperating experiences with ice cubes are something few escape. But this item may eliminate the difficulty—dividers for Lady Fairfax ice trays. Molded of Tenite II by Kuhlman Plastics Co. for Fairfax Engineering Co., Inc., the flexible dividers have a smooth surface to facilitate removal of the cubes

Made for the country gentleman this Hedge-Klip has Durez handles, with metal inserts, to assure a firm grip for directional cutting. Erie Resistor Corp. produces these phenolic handles for the Accmatool Co., Inc.

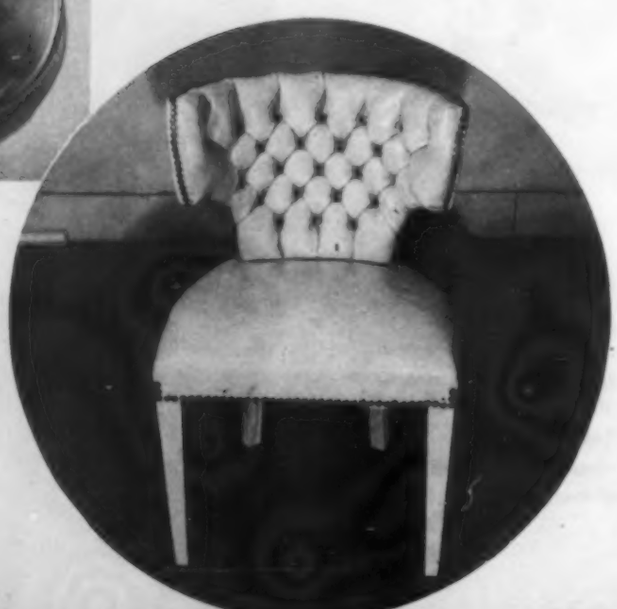
DRESSING UP THE HOME

For the record—Hastings House's diary and notebook with Teralin covers. Material is long-wearing, easily-cleaned, pyroxylin-impregnated rayon — the first to take 4-color printing. Designs were printed by Harrison Art Advertising with wax color plates

A handsome setup for treasured glasses. To fabricate these Plexiglas coasters, 0.125 in. thick sheet is cut into squares. Then Cass Plasticrafters uses 2 forming tools and 1 cut off tool to cut grooves and round edges simultaneously



There's a cheerful earful in a musical powder box molded of acrylic or acetate by Keolyn Plastics Co. for Decatur Industries, Inc.



For that modern look—a chair with simplicity of line and with Koroseal covering. It was designed and made by Contempo Shops, Inc.

Cellulose propionate in the field

by JOHN J. KEVILLE, JR.*

THE material Forticel[1] is plasticized cellulose propionate, made from the reaction of propionic acid anhydride with cellulose in the presence of a catalyst. This ester was studied by our company engineers more than 20 years ago and found to be an important member of the cellulosic family. Practical and economical methods of production could not be realized, however, until propionic acid was available in sufficient quantity, in proper quality and at a reasonable cost. This problem was solved when the new chemicals plant of Celanese at Bishop, Texas, was placed in operation and propionic acid derived by a new process from petroleum raw materials. Although this was a determining factor in the decision to manufacture cellulose propionate plastic, of equal significance were the years of research covering cellulosics which indicated that cellulose propionate would possess a balance of properties not yet achieved by other cellulose base plastics.

It was found, for example, that the cellulose ester exhibits regularly defined relationships as the number of carbon atoms in the esterifying acid is increased from acetic (two carbon atoms) to propionic (three carbon atoms) on through to butyric acid (four carbon atoms). Moisture sensitivity decreases with the addition of carbon atoms, but there is also a decrease in hardness and rigidity. Cellulose propionate promised a highly satisfactory combination of low-moisture sensitivity and superior rigidity—a promise that has been realized with field trials. The decision to manufacture cellulose propionate plastic on a large scale was made when laboratory production and evaluation confirmed the encouraging preliminary conclusions noted above.

The initial program restricted

It was decided to present Forticel first in the form of molding material since the process promised less complications for pilot plant and eventual large scale production, and a wide variety of applications was immediately available for evaluation and comparison with competitive resins.

To determine the range of formulas in which the material would be offered and to develop a background of molding technique, it was tried in the laboratory in as many types of molds as possible, under widely varying molding conditions and for many different end uses. Some molding was done in outside plants under the supervision of our own engineers when problems arose for which the laboratory equipment was inadequate. However, for the most part Celanese facilities were employed for the major portion of the work to this point.

Since it is acknowledged that all of the problems connected with the handling of a new material cannot be predetermined by laboratory testing alone, a broad program for the field evaluation was initiated.

The following points were considered in selecting applications for which this cellulose propionate should be tried:

1. End uses which demanded certain properties of Forticel that had already been proved in the laboratory through tests.
2. Molding technique requirements which would demonstrate molding characteristics already proved in the laboratory.
3. Applications which would yield experience to fill in gaps resulting from inadequacies of laboratory trials.
4. Long-term, volume applications suitable for cellulose propionate and for which it was desirable to establish the material even though commercial production was not available.

These trials were supervised by Celanese technical representatives. Wherever possible, their detailed reports compared Forticel with competitive materials over the complete range of molding and finishing operations, and the comparison was carried through to exhaustive tests on finished parts. Comments and suggestions of machine operators and end users were solicited. Some of the parts molded at this time were toothbrush handles, optical frames, industrial hous-

The birth of a product is justifiably attended by fanfare which fades as still newer developments compete for public interest. Though entirely natural, this is a paradox for it is not until a product has been manufactured in excess of laboratory quantities and tested under all conditions that its true stature emerges, regardless of the initial claims made by the manufacturer.

This article on Forticel, published just a little more than a year after its introduction on October 17, 1945, reviews the development of this material and evaluates it in the light of one year of exhaustive field trials.

* Director, Product Application Dept., Celanese Plastics Corp.
[1] Reg. U. S. Patent Office.

"Touch appeal," toughness over a wide temperature range helps to give cellulose propionate its popularity for such general utility items as tool handles, flashlight housings and vacuum parts

A lustrous finish, shorter molding cycles

ings, combs, saw handles, screw driver handles, flashlights, doll bodies and heads, fountain pens, pencils.

Molding and finishing characteristics

A definite pattern of characteristics emerged from this varied experience, confirming original laboratory findings in most respects, and, in some cases, yielding unpredicted dividends. To illustrate, although cellulose propionate parts molded in the laboratory showed surfaces with a high finish, it was not until extensive field molding had been done that this was recognized as an important property of the material. This finish was so lustrous and free from smudge that many parts required no further buffing. This desirable gloss was maintained over widely varying injection cylinder temperatures and machine cycles On the basis of this factor alone molders speculated on possible cost savings.

Shorter molding cycles was another advantage discovered in field work which was not evident in small-scale laboratory testing. A two-cavity vacuum cleaner hand nozzle die, normally operating with other cellulose ester molding materials on a 51 sec. over-all cycle, was successfully run with cellulose propionate on an over-all cycle of 40 seconds. The cycle on a large one-cavity automotive dashboard bevel die was cut from 45 to 37 seconds. Cycle reduction cannot be achieved with Forticel on every injection mold, being governed by such factors as the presence of inserts, machine limitations, moldings with heavy cross-sections or ribbings which must be held under high pressure until cooled or hardened. However, in no case did cellulose propionate require a longer cycle than the standard material.

The material also enjoys excellent flow characteristics which are responsible for the wide range of molding temperatures over which satisfactory parts can be made. Where other cellulose ester plastics are limited to a deviation range of 30 to 50° F., this cellulose propionate produces good pieces over a range of 80° F. While this does not mean that control of molding machine variables (particularly temperatures) can be relaxed, it does permit a more rapid setup of new jobs and facilitates the interchange of dies in different machines. The material fills readily through small gates and has excellent welding properties. Both impact and tensile tests show superior weld strength.

The small gates possible with cellulose propionate permit easy degating, with less chance of breaking back into the molding or tearing up skin. In all except the hardest compositions there is no trace of skin or laminations, a point which is of distinct value in such uses as toothbrush handles where high speed drilling is performed. The lens receivers of thin wall cellulose propionate optical frames were cleanly routed with no difficulty on high speed routers even when the frames were molded over a wide temperature range. All types of machine operations can be done easily with Forticel. Parts molded of this material can be cemented as readily as parts of cellulose acetate, with some modification in the cement required.

Properties of molded parts

Just as important as the molding and finishing characteristics of the material are the properties of the molded parts. The absence of any objectionable odor, both during molding and in the finished piece, is due to the fact that cellulose propionate is an unusually stable

Cellulose propionate cuts molding cycles for large-section pieces like automotive parts, housings, gun stocks. High impact strength and permanent surface luster are characteristics of material

and easier machining characterize cellulose propionate

ester. Forticel (which has specific gravity of 1.17 to 1.22) has a greater yield per pound than does cellulose acetate (with specific gravity of 1.27 to 1.34).

The cellulose esters become more plastic as the number of carbon atoms in the acid increases so that less plasticizer is required with the higher cellulose esters than with cellulose acetate. With a plasticizer level in many formulas less than 50 percent of that needed in cellulose acetate compositions of comparable flexural strength, cellulose propionate exhibits greatly superior aging characteristics. The increase in molecular chain length, changing the compatibility of the cellulose ester with plasticizers and solvents, makes available a much wider selection of non-volatile plasticizers than for cellulose acetate, permitting greater formula flexibility. To the designer and molder this means the plastic can be adapted to the job rather than building the part around material limitations. Table I shows range of properties currently developed.

The flow temperature range, and the value of 161° C. as given in Table II may seem high. This does not mean that molding temperatures are high or that cellulose propionate is difficult to mold. While A.S.T.M. flow temperature is a fair guide to molding temperature within the formulations of a single plastic, it is not reliable when different plastics are being compared.

Table II shows the variation in flow temperature of a group of cellulose ester and ether molding compounds which all have the same minimum molding temperature. These compositions were all molded with the same injection machine and die, using the same cycle, the same die temperature and the same differential between the front and back heater. The minimum molding temperature listed is the lowest front heater temperature at which full shots could be obtained consistently on steady cycle. Commercial molding temperatures would be 35 to 50° F. above figures given.

ALL PHOTOS, COURTESY CELANESE PLASTIC CORP.

Delicate machining and finishing have been accomplished on these sports goggle frames of cellulose propionate

Field evaluation with many different applications has established cellulose propionate as a very tough plastic. High Izod impact values, such as the 11.4 given as a maximum in Table I, can only be related qualitatively to the impact readings obtained in a number of similar moldings. Molded Forticel housings have shown superior shock resistance in drop tests and falling ball tests to other cellulose ester compositions. Ethyl cellulose is still the toughest cellulosic, particularly at low temperatures, but cellulose propionate will provide the next highest level of shock resistance consistent with the maintenance of other desirable characteristics.

(*Please turn to next page*)

Cellulose propionate flashlights passed a cold impact test of 12 and 20 ft. lb. at −10° F. Other cellulose ester compositions when formulated to meet like shocks have considerably higher shrinkage characteristics than cellulose propionate upon repeated cyclic aging tests. In addition, flashlights molded of other materials warped and distorted under exposure to 175° F., for 24 hr. followed by 24 hr. at 130° F., and 95 percent relative humidity. The cellulose propionate flashlights passed such a heat and humidity test satisfactorily.

Table I.—Physical Properties of Forticel

Property	*A.S.T.M. Method*	*Minimum*	*Maximum*	*Average*
Flow, °C.	D 569-43	150	177	161.5
Rockwell hardness	D 229-43	R 63	R 104	R 97
Specific gravity	D 176-42T	1.17	1.22	1.19
Distortion under heat, ° C.	D 648-41T	49	66	52
Weight loss on heating 72 hr. at 82° C. %	D 706-43T	0.3	2.2	1.5
Water absorption (24 hr. immersion), %	D 570-42	1.0	1.7	1.4
Soluble matter lost (24 hr. immersion), %	D 570-42	None	0.1	None
Elongation, %	D 638-42T	25	43	35
Tensile strength, p.s.i.	D 638-42T	2800	6000	4070
Flexural strength, p.s.i.	D 650-42T	4800	10,000	6730
Impact strength (Izod), ft.-lb./in. of notch	D 256-43T			
25° C.		0.8	11.4	7.8
−40° C.		0.7	1.2	0.8
Power factor at 1 Meg.	D 150-42T	0.019	0.032	...
Dielectric constant at 1 Meg.	D 150-42T	3.3	3.5	...

The comparatively lower moisture sensitivity of cellulose propionate contributes to superior dimensional stability. It is not the moisture absorption which matters but the effect of this moisture on the dimensions of the molded piece. The increase in length at equilibrium in going from 0 to 90 percent relative humidity is 0.4 percent.

Table II.—Relation between Molding Temperature and Flow Temperature

Material	*Minimum molding temperature*	*Flow temperature D 569-43*
	° C.	
Cellulose acetate	465	314.6° F. (157° C.)
Cellulose acetate butyrate	465	303.8° F. (151° C.)
Cellulose propionate	465	322.7° F. (161.5° C.)
Ethyl cellulose	465	288.5° F. (142.5° C.)

The expanded program—non-restricted

At this point the sales organization was advised that sample quantities were available for customer evaluation, regardless of application though priority would be and still is given to those end uses which promise to add something significant to the rapidly expanding cellulose propionate background. To insure a sincere interest in carefully evaluating the material, bona fide orders are required, accompanied by data on end use and molding conditions. Molders are not expected to have company engineers present when running the material, although this service is available and customers are urged to take advantage of it.

To facilitate prompt shipment of samples, an inventory is maintained in five standard colors and six formulas. Molders are urged to submit reports and finished parts. Any difficulties are promptly investigated.

This phase of the program, which may be termed the non-restricted field evaluation, will end when the experience and background resulting from broad and varied trials is considered sufficient to cope with any problems involving cellulose propionate and when more than limited production is achieved. Extrusion compositions are currently under restricted field evaluation; development work on cellulose propionate film, sheets, rods and tubes is being carried on in the laboratory.

OF INTEREST TO THE PAINT, PAPER and textile industries is a new aqueous film-forming material, Latex 512, which has been announced by the Dow Chemical Co., of Midland, Mich. It can supply those industries facing current short supplies of edible vegetable oils.

A combination of styrene and butadiene, Latex 512, is said to form a rubbery and tough film with excellent pigment binding properties and a high protective value when air dried. It is also compatible with many aqueous emulsions or dispersions of resins, oils, varnishes, starches, waxes, casein, plasticizers, water soluble gums, pigments.

A 4-in-1 plastic toy car kit

NUTS, bolts and a screw driver are all a young mechanic needs to build up a durable plastic racer, roadster, coupe or sedan—if he has a four-in-one Kar-Kit. This kit, containing cellulose acetate, styrene and die cut metal sections for each part along with instructions, necessary screws and tools, is being manufactured by Toy Founders, Inc., of Detroit, Mich. It was designed by Sundberg-Ferar of Detroit, with the idea of giving the 7 to 12 year old child a chance to show his mechanical ingenuity.

The cellulose acetate parts are all produced by Standard Products Co., Detroit, Mich. The car body is molded in a 2-cavity automatic hole coring mold. Fenders are produced in a combination 4-cavity mold of one right and left front fender and one right and left rear fender. They are molded at an angle so that a depressed cat walk can be formed. Sprues are not cut off these parts but retained as locating pins in the assembly of the toy autos. Threaded inserts are molded into the rear fenders so the parts can be fastened to the body without screw heads marring streamlined effect.

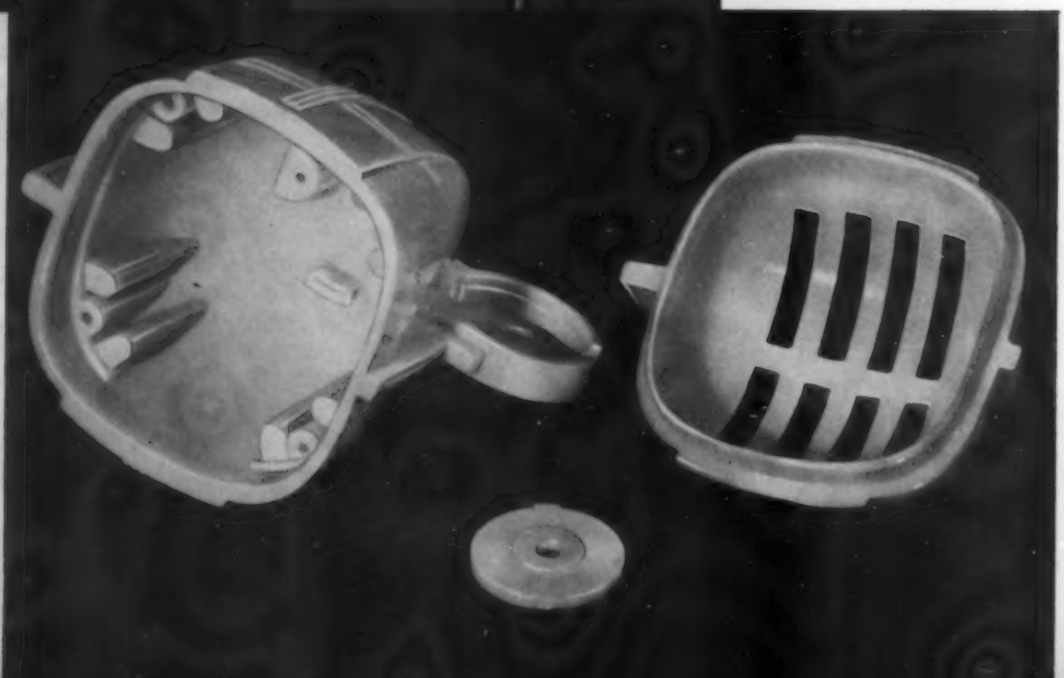
This molder uses a 2-cavity mold for the polystyrene tops; a 4-cavity mold for the styrene windshields. Again sprues are left on the molded parts. On both the tops and windshields they serve as supporting posts which slip into holes in the body. The spring of the plastic is sufficient to hold the top on. Unusual masking devices are used to spray the tops and to produce the windshield and window effects. These masks are built up by a special electro-plating process to allow a thin section of the metal to seal tightly against the clear molded plastic thus preventing any leakage of the spray from smearing under the masks.

The die cast parts—the zinc frame, front and rear bumpers, right and left bearing caps for the axles, the right and left chrome-plated exhaust pipes—are produced in a combination 7-cavity die-cast die by Univex Die Casting Co. of Detroit. The hub caps are of machined and polished aluminum and are screwed onto the threaded steel axles. The tires are of composition rubber. Engineering was handled by the American Plastics Engineering Corp., also of Detroit.

Cellulose acetate

1—*Cellulose acetate housing of this microphone lends a bright note of color to night clubs, theaters and other locations, and has the advantage of being warm to the touch*

2—*Three injection molded parts make up this microphone housing—the front grill, body and small cover disk*



microphones look and sound well

PLASTICS may be the answer to your problems of competition. The Turner Company found them so when, the war over, it focused its attention on peacetime uses for microphones and electronic equipment, products in which it had long been a leader. This organization realized that superior microphone performance, based on improved interior construction, was naturally an important consideration in the new models. But it was equally aware that additional exclusive features would pave the way to even greater merchandising advantage.

An analysis of the locations in which microphones are used emphasized the growing demand for these instruments in public address and sound systems for theaters, restaurants, public meeting places, night clubs and entertainment spots. Here Turner executives saw an opportunity to bring about real improvement by giving color to their microphones. No matter how attractively a metal instrument of this type is designed, it tends to inject a cold mechanical note into an atmosphere warm with life, music and color.

Once the decision to produce a colored microphone was made, the choice of molded plastics was almost a matter of course. Careful analysis of the job indicated the selection of cellulose acetate, not only because of the wide range of permanent lustrous colors available but also because of the toughness of the material, which provides the requisite protection for the sensitive electrical parts within the housing.

A three-part molding job

Arthur C. Haggstrom did the designing of the new "mikes" which are injection molded of Tenite in brilliant red, rich orange, bright yellow and soft pastel green by Chicago Molded Products Corp., Chicago, Ill. There are three cellulose acetate parts in all—the grilled front piece, the body and a small circular cover for the swivel tab through which the wires enter the housing. Two molds are used—a single cavity mold for the body and a combination mold for the grill and cover.

The over-all effect of the plastic parts after assembly is of a streamlined unit which is both functional and pleasing in appearance (Figs. 1 and 3). And tests have shown that both the crystal and the dynamic model microphones, the two units available with the cellulose acetate housing, are relatively unaffected by temperature and humidity changes when encased in plastics.

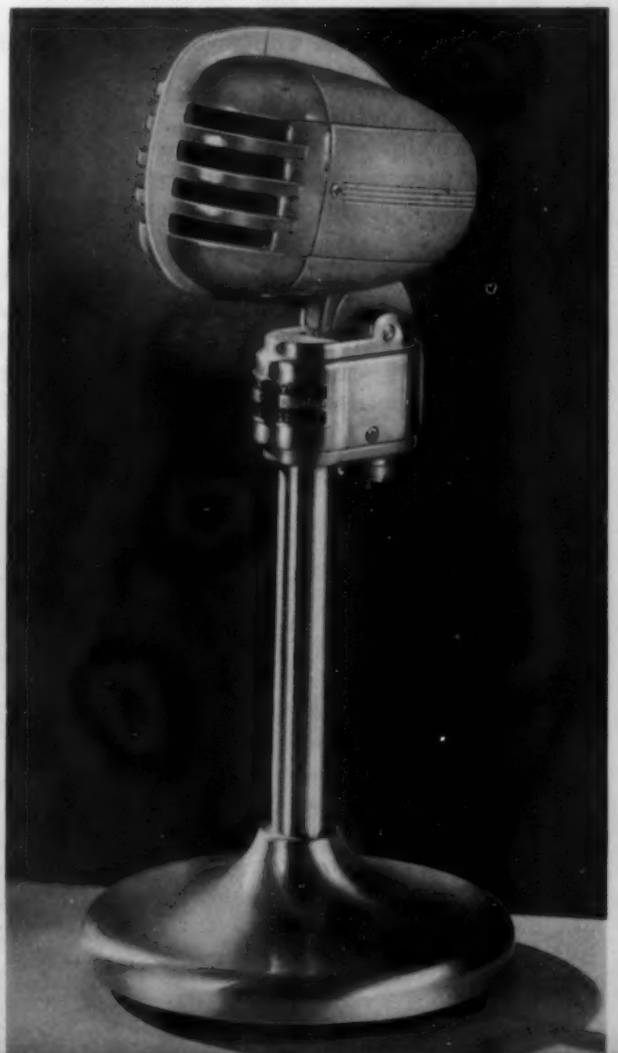
A rugged, functional housing

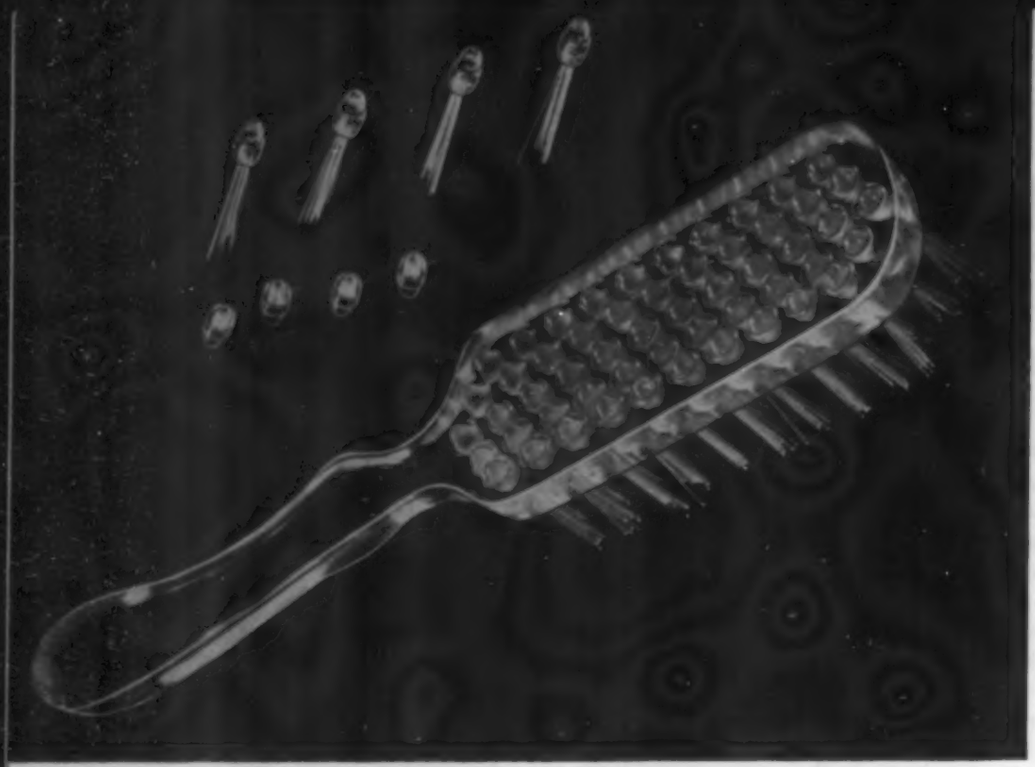
Thanks to the inherent properties of the acetate material the microphones are warm to the touch. And, due to the electrical insulating properties of the plastic, touching the "mike" produces no noise or clicks caused by static discharge or other electrical disturbances. Furthermore, the thermoplastic material is highly resistant to physical shock, providing adequate strength to meet handling and hazards incident to normal use.

This microphone and electronic equipment manufacturer believes that the new plastic microphones, with their added beauty, rugged design and improved performance characteristics, should do much to bring the microphone to the front as a pacesetter. Of special interest, of course, is the fact that the range of colors available permits selection of an instrument which will blend harmoniously with the color scheme of the particular night club, auditorium or other location in which it will be used.

3—The four colors of cellulose acetate used in these "mike" housings are bright red, yellow, orange, soft green

FIGURE 1. COURTESY CHICAGO MOLDED PRODUCTS CORP.





Revolving bristles and rotating scalp massage tips were made possible in this methyl methcrylate brush by bearing type bristle holders that swivel back and forth as hair is brushed

A brush with 55 molded acrylic parts

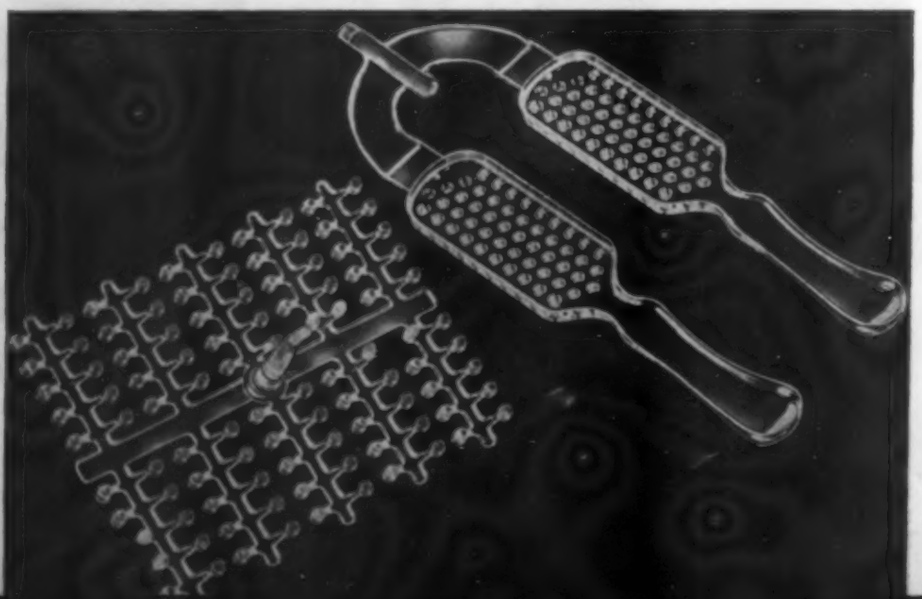
The Idea: A hairbrush with revolving bristles and rotating scalp massager tips.

The Problem: The creation of a brush which would carry out the basic idea with no sacrifice of appearance, ight weight or compactness—necessary properties in any type of hairbrush, no matter how new and unusual it may be.

The Solution: An all-plastic brush with acrylic back and bristle holders, and nylon bristles. Plastics were chosen for this Bennart brush, the invention of Arthur Grusin, because they alone gave the close tolerance needed for the proper assembly of bristles and bristle holders, the fine detail, the sparkling appearance and the light weight that would assure a quick sale and long trouble-free service.

G. Felsenthal & Sons, of Chicago, are responsible both for the molding of the Lucite handles and beads, and for all the fabricating operations except the stapling of the bristles in the plastic bearings. It is this bead or bearing which locks each tuft of bristles in position, yet permits it to swivel freely as the brush is used.

The clear Lucite handles for the ladies' style brush are produced in a two-cavity mold on a 16 oz. Impco combination injection and compression press. The extreme clarity of the handles is attributed to the



One hundred barrel-shaped beads for bristles are molded at one shot, enough for two brushes. When bristles are inserted, beads are positioned and locked in place in one operation

double action of the press, which imparts a 50-ton compression pressure to the die following injection, through the action of a vertically acting bottom ram. This feature of the molding cycle, it is claimed, eliminates air bubbles and weld lines.

Molding of the handles is complicated by the fact that they are concave on the back, with the two outer rows of bristle holes on an outward slant rather than vertically disposed. Notwithstanding this fact, the 54 cores forming these tapered openings are successfully withdrawn from the female cavity as the die opens. Details on this mold action are not available for publication at the present time.

After removal of the handles from the mold, the heavy gates are cut off with a circular saw and ground smooth. The parting line, running around the upper edge of the handle, is then buffed to give the edge a more pleasant feel in the hand.

The barrel-shaped beads, less than $^1/_2$ in. in length, have a minute opening into which the bristles are stapled. Made in a 100-cavity die on a Reed-Prentice 4 oz. injection press, they are simultaneously de-gated in a matter of seconds by a special cut-off die used in a kick press. The beads are molded with a shoulder which prevents their passing through the tapered cores in the brush handle.

After being fitted with bristles, the beads are placed in the handle openings and locked in position in a single operation by a multiple swaging tool. The latter operation is performed so accurately that a vertical play of 0.040 in. is left in each tuft.

The beads are so designed that they project about $^1/_8$ in. above the back of the brush, presenting a rounded surface with which the scalp may be massaged. Here, as in the case of the brushing action, the ball bearing type of mounting employed adds to the utility of the brush. Bristles of each finished brush are struck with a rubber tool to make certain they are securely fastened and will turn freely.

There are other advantages besides scalp massage that are claimed for this hairbrush. The inventor points out that because the bristles are free to rotate in their sockets, they will last much longer than fixed bristles since the wear will be evenly distributed instead of confined to one or two directions. It is also said that the relatively large amount of space between the bristles, combined with the revolving feature, affords greatly improved brushing action.

The brushes, made for Bennart Brush Co., are packaged in clear acetate setup boxes fabricated by Central States Paper & Bag Company. They will also be made in a men's model with 63 bristles and it is later planned to bring out a toothbrush with the same revolving bristle construction.

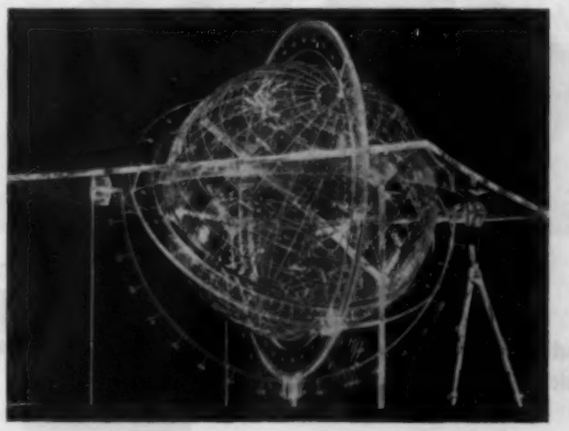
GOING AROUND THE WORLD OR PEERing through the world is easy with this Plexiglas celestial globe, for this working model of the universe provides a graphic representation of the heavens as they actually appear to the observer. It can be manipulated to show the position of the stars at any given season or time of day.

All parts are plastic, including screws, bearings, etc. There are between 20 and 25 parts, depending on the model — 5 in. or 9 in. globe. The globe is free blown by Tarquhar & Kugler, Concordville, Pa., manufacturer and distributor, and component parts are assembled in the conventional manner using solvents. Frank L. Motson, Philadelphia, Pa., does the printing on the globe.

Acrylic was selected in preference to glass because of its durability, lightness and ability to be blown uniformly without difficulty.

A student of navigation or person who makes a hobby of astronomy can work out many practical problems on the globe. He can determine compass direction, tell the correct time by observation of sun or stars, fix approximate latitude and longitude, determine the time and direction of sunrise and sunset for any day of the year from any geographical location, understand the paths of the sun, moon and planets, demonstrate the ecliptic pole, obtain a true picture of the heavens from any point on earth at any time, demonstrate graphically equation of time and precession of earth's axis, identify stars, constellations.

And it's not difficult. Observations in the globe are made on the concave surface as if viewing the sky. Figures on the time ring must be right side up while the equator is always in a plane parallel to the earth's equator when the globe is oriented to the universe.



Micarta

THE MATERIAL THAT CHANGED THE MEANING OF 'PLASTICS'.

Micarta is a *tough, workable* material with qualities which bear little resemblance to old conceptions about "plastics". Micarta is an industrial laminate—geared to today's requirements. It's used in hundreds of applications . . . such as auto timing gears, marine bearings, refrigerator inner door panels . . . to name a few.

Design engineers have unlimited possibilities in Micarta. Here are some of its qualities:

HEAT-RESISTANT—unaffected by temperature changes from 250° to —112° F.

STRONG AND LIGHTWEIGHT—Strength of aluminum at half the weight.

MOISTURE AND ACID-RESISTANT—withstands water submersion or mild acid or alkali solutions.

WORKABLE—can be drilled, tapped, milled, die punched, sawed.

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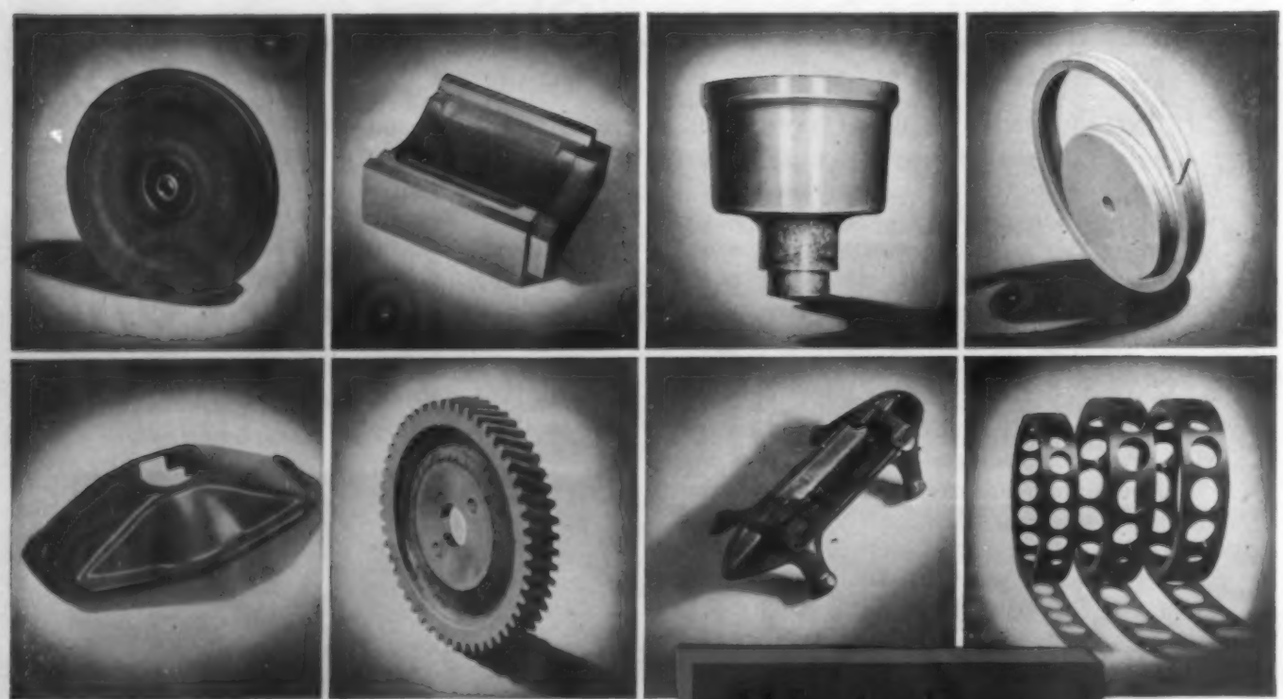

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Plastics engineering in 1946

Improvement of materials, processes and equipment, not new plastic developments, held the field in 1946

THE year 1946 was one of development rather than of discovery in the plastics industry. The outstanding work was in the improvement of materials, processes and equipment already familiar to those in the field. Of particular significance was:

1. Improved sandwich laminates consisting of thin-gage high-strength skins separated by a low density stabilized core.
2. A new process of impregnating cotton yarn with synthetic resin.
3. New equipment for automatically forming boxes from cellulose acetate or vinyl sheeting.
4. Annealing of polystyrene and related resins.
5. Metal coating by vacuum evaporation.
6. Machining with diamond tools.
7. Beryllium copper as a mold material.
8. Plastic molds for electronic vulcanizing.
9. A new mold base.
10. Vertical-acting injection molds.
11. A system of compression molding called the "magazine" method.
12. A laboratory size molding machine capable of being operated as a conventional injection, compression or transfer unit.

On the following 10 pages these 12 improvements are reviewed in brief, grouped as to whether they concern materials, methods of handling, treatment and finishing, mold materials, molds or processing equipment.

Honeycomb core structures[1]

Wartime experience gave industry a wealth of information on plastic sandwich structure, not only as to its manufacture but as to the advantages of various materials for core and skins. These laminates are natural applications where weight is extremely important—in aircraft, for example.

Many of the new planes and some reconversions will have flooring made with honeycomb faced with either plywood or aluminum alloy skins. In one installation a 35 percent saving in weight with a 30 percent increase in strength was effected. The service life of this floor is expected to be several times that of the floor it replaces. Honeycomb panels for partitions, doors, shelving, table tops, work surfaces with thin stainless steel skins, air ducts and other structure where the stiffness-weight ratio determines design are rapidly being engineered and installed in these planes.

As more service data is obtained it is not too far fetched to imagine that entire fuselage sections may economically be fabricated with honeycomb constructions. In fact in the Glenn L. Martin Company, Baltimore, Md., Model 202, Twin-Engine Transport plane the honeycomb sandwich flooring is designed to take primary loads as part of the fuselage structure.

Honeycomb constructions are also finding a place in other forms of transportation. While it is too early to disclose specific applications it is noted that through economies in fabrication and because of the value of the weight saved, honeycomb panels are being used in industrial trailers, railroad passenger cars and house trailers. To date prototypes have been engineered for air freight shipping containers, cold storage shipping containers, scaffolding, lightweight furniture, partitions, trays and many confidential projects.

The core—Of the many sandwich laminates that have been developed over the last few years those with honeycomb cores have shown the greatest promise. This core is made of a resin-impregnated sheet material which has been cured and assembled into the form of nested hexagonal-shaped cells resembling bees' honeycomb. Naturally, the material selected to make the core is determined by the end use of the sandwich. For most commercial applications, low-cost cotton sheeting or paper impregnated with a phenolic-type resin has been found most satisfactory. However, where electrical properties are of prime importance a Fiberglas cloth impregnated

* Reg. U. S. Patent Office.

[1] "Honeycomb core structures," by O. S. Tuttle and W. B. Kennedy, MODERN PLASTICS 23, 128–135, 194, 196 (Sept. 1946).

Table I.—Physical Properties of Honeycomb Cores

Core material[a]	*Core weight*	*Shear strength*[b]	*Shear modulus*[b]	*Compressive strength*
	lb. per cu. ft.	*p.s.i.*	*p.s.i.*	*p.s.i.*
4-oz. cotton sheeting	3.75	140	9,000	340
8-oz. cotton duck	7.8	248	13,000	710
Fiberglas cloth, ECC 128 cloth	5.75	150[c]	9,000[c]	350[c]
11 mil paper	3.5	180	17,000	360[c]
Asbestos paper	4.5	160[c]	11,000[c]	350[c]

[a] All material was impregnated with a phenolic type resin except the Fiberglas cloth which was impregnated with a polyester type resin.
[b] Parallel to Corrugations—Preliminary test results indicate that the corresponding values perpendicular to corrugations will be approximately 50% of these values.
[c] These values are estimates based on preliminary information and are believed to be conservative.

with a polyester resin is indicated. And where fire resistance is necessary, an asbestos paper with phenolic resin will probably be found most satisfactory. For good thermal insulation it is necessary to introduce an insulating material into the cell since honeycomb by itself has a K factor little better than that of solid lumber. The more important physical properties of some of these core materials are listed in Table I.

Although the optimum cell size has not as yet been determined, the United States Plywood Corp., New York City, has set up production equipment to make a honeycomb core with a $^3/_8$ to $^7/_{16}$ in. cell size measured across the flats. This core is satisfactory and economical for nearly all applications. However, if for structural or other reasons a smaller or larger cell size is specified, it can be obtained through special orders.

Since inserts and fittings are determined by core thickness rather than by total thickness of the panel, obvious production economies result from standardizing on a relatively few thicknesses of core. Therefore, standard thicknesses have been selected as follows: 0.250, 0.3125, 0.375, 0.4375, 0.500, 0.625, 0.75, 1.00 inch.

Face materials—Just as the material in the honeycomb core can be varied to meet specific requirements, so can the material for the facings or skins. Excellent structural properties, for example, may be obtained by using thin gages of high-strength high-modulus metals such as stainless steel, aluminum and magnesium. Two or more ply decorative veneers, or high or low pressure laminated plastic sheets, when used as the facing give a good appearance and satisfactory strength properties. Excellent electrical properties are obtained through the use of laminated Fiberglas skins or Fiberglas honeycomb core; fire resistance is imparted by stainless steel or laminated asbestos paper skins on asbestos honeycomb core. There are many other possible skin and core combinations using either decorative fabrics or other plastic laminates.

The important thing is that the same material, or materials with approximately equal coefficients of thermal expansion (though different gages are satisfactory) should be placed on both surfaces of the core to maintain a balanced construction. Otherwise, warping will result. Further, it is probably economical to face compound curved parts with a fabric laminate since it is necessary to preform these skins, a procedure which would require expensive dies were metal to be employed for them.

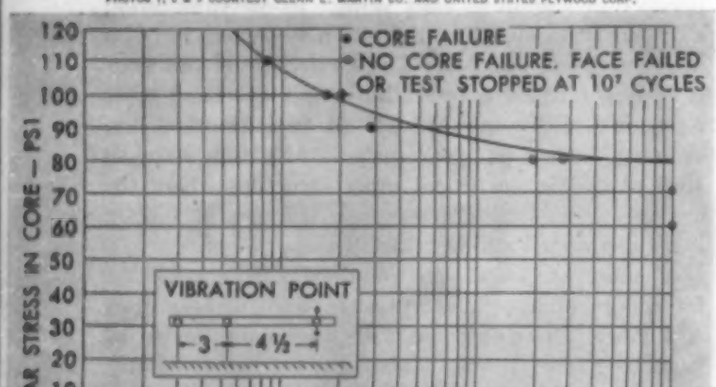
Manufacturing processes—As industry returns to a competitive state, individual companies are reluctant to disclose manufacturing processes which have been developed at considerable expenditure of time and money. In the case of honeycomb core structures a good share of the development expense has been incurred in finding out how not to do things. While that education is still going on, certain clear-cut procedures are taking shape.

The honeycomb core may be cured on a corrugating drum in the form of a continuous corrugation. These sheets are cut to length, indexed and assembled into block form—making in effect a honeycomb log. The *log* is sliced on a band saw into sheet form for panel assemblies.

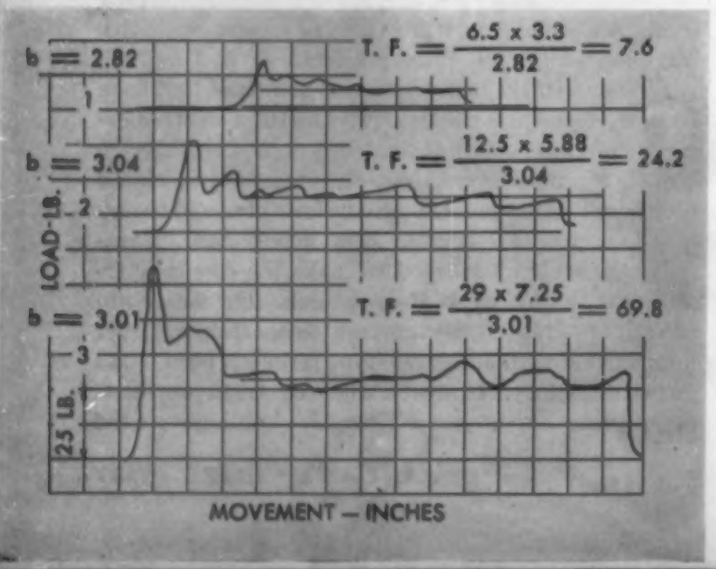
By another method, honeycomb core may be made

1— Fatigue limit of about 70 p.s.i. shear stress in honeycomb core is indicated in these flexural fatigue tests

PHOTOS 1, 2 & 3 COURTESY GLENN L. MARTIN CO. AND UNITED STATES PLYWOOD CORP.



2—These curves indicate the energy required to strip 0.016 in. ST Alclad sheet from a honeycomb core. Bond was brittle in sandwich charted at top. Bottom curve shows toughness of thermoplastic adhesive at room temperature



by (in effect) strip gluing to a pattern single sheets of material which are then assembled in a stack for curing in a press. The cured solid blocks are cut into strips which are expanded, Christmas-bell fashion, to make honeycomb core sheet. The expanded honeycomb is sprayed or dipped in a resin bath, air dried and cured in an oven. The technique may be varied somewhat depending upon the material and resin which are used in making the core.

The process from there on is typical of any good panel assembly operation. Care must, however, be taken that the right amount of the assembly adhesive is properly distributed on the honeycomb core. While the process sounds simple, it has been determined that careful attention to many small but important details is necessary to insure well-bonded panels.

Much development work remains to be completed, particularly in the design of production machinery for low-cost honeycomb, but enough work has been done that the possibilities of the material may be visualized.

Design details—In the application of honeycomb core structures it has been found that the fabrication of individual panels into finished products introduces some unique problems not experienced in other types of structural materials. In most cases, the problems can be attributed to the extremely low density of the core and the very thin faces. Both of these facts make it necessary to locally reinforce the core and improve the bearing area of the sandwich at points where structural attachments are to be made.

In most cases high density inserts and edge banding molded into the panels are desirable. The materials commonly used are wood, plastic, aluminum extrusions and even solid aluminum. As an alternative, a spacer bushing made of an aluminum alloy was designed for use on panels where attachment points could not be predetermined. It is a general-purpose fitting in that it can be inserted at any point in the panel and will transfer loads in the plane of the plate as well as normal to the plate. There are several variations of the same general idea that can be used. Our tests indicate that maximum strength is attained by bonding these fittings into panel with Plycozite adhesive.

A yarn-impregnating process[2]

The past year has also seen advances in the handling of materials. A case in point is the process developed by Riverside & Dan River Cotton Mills, Inc., Danville, Va., of impregnating cotton yarn to prevent the slippage of one fiber along another parallel fiber. It is said that by using this process, conventional processes such as spinning, spooling, warping and twisting can be eliminated. There is also reported to be an average increase in tensile strength of rovings, yarns or cords ranging from 40 to 60 percent. As this will affect even short-staple rovings or yarns, it will mean that it will be easy to fabricate low-grade cottons which are not suitable for conventional cotton manufacture.

[2] "A new yarn-impregnating process," MODERN PLASTICS 23, 196 (June 1946).

3—Honeycomb cores are among the most successful for sandwich type structures similar to this airfoil section

As the equipment for this process has been constructed by Walter Kidde & Co., Inc., Belleville, N. J., there are two stages in the work—one for impregnating (Fig. 4), the other for curing the resin. Roving, or yarn, is sent first to the yarn-impregnating machine where the fibers are subjected to a synthetic resin wetting bath, with or without a pigment, and then rewound on a spool or bobbin. After the yarn has aged a while it is fed under uniform tension to a snubbing device in the second unit in this setup. Here the fibers are run across a two-faced heated grid which dries the yarn and sets the bonding agents. Extraneous material is then scraped from the roving and the yarn given a surface polish. A receiving spool takes up the finished resin-bonded yarn.

The two units described above have also been combined into one machine in order to simplify and speed the work. But even with this combination equipment it is necessary to age the resin-treated yarn, a step which

4—This equipment for the resin impregnation of yarn includes a unit for drying as well as for the impregnating

PHOTO, COURTESY RIVERSIDE & DAN RIVER COTTON MILLS, INC.

the companies hope to eliminate through further research in the field.

Rigid folded vinyl and acetate boxes[3]

Improvement in the handling of plastic materials during 1946 also had its effect on the packaging field. For example, the new equipment brought out by John H. Oxley Co. of Watertown, Mass., for automatically forming boxes from cellulose acetate and vinyl sheeting made possible the production of boxes without the use of acetone to seal the corners. A further advantage of these boxes is their reinforced sides.

The process centers around the manner in which the flat sheets of plastic are slotted and folded. For a box that is to be 5 in. deep, four slots, 10 in. long and positioned 5 in. in from the sides of the sheet, are cut from the material. The slot must be 10 in. long to permit a double fold of the material which gives the sides of the box two thicknesses of sheet. The cutting of the slot 5 in. in from the ends is correct for boxes without reinforced ends; but if the ends too are to have a double thickness of the acetate or vinyl the slot must be made 10 in. in from the ends of the flat sheet. The positioning of the slots and their length are evident in Fig. 5.

After die stamping, the slotted sheets are fed into the semi-automatic forming machine which is equipped with a knife-edge heater. With this equipment it is not necessary to heat the entire sheet of plastic for shaping—only thin lines of the material where the actual creases are made. In the following steps the material is bent to shape. First it takes the appearance of the box second from the right at the top in Fig. 5. Then the ends are bent upward. The second fold on the two sides of the box, which gives it the double reinforcement, is made one side at a time.

These boxes have found a market not only as containers but as displays and reuse boxes. It is possible to get all types of combinations through the use of transparent, opaque and patterned sheeting or by hot stamping or silk screening of the plastic after forming.

Annealing of styrene and related resins[4]

The plastics industry's interest in polystyrene more than explains the attention that has been given the work of annealing this material and related resins as a means of reducing internal stresses to a point where the residual stresses after annealing can be borne safely by the material during its life without crazing or cracking.

The first requisite of any attempt to study annealing of polystyrene was some method of finding the degree of residual strain. Then it merely became a matter of study by trial and error to develop an annealing cycle for polystyrene rod (say 1 in. in diameter) and from this to deduce other cycles for the various sizes and shapes to be manufactured.

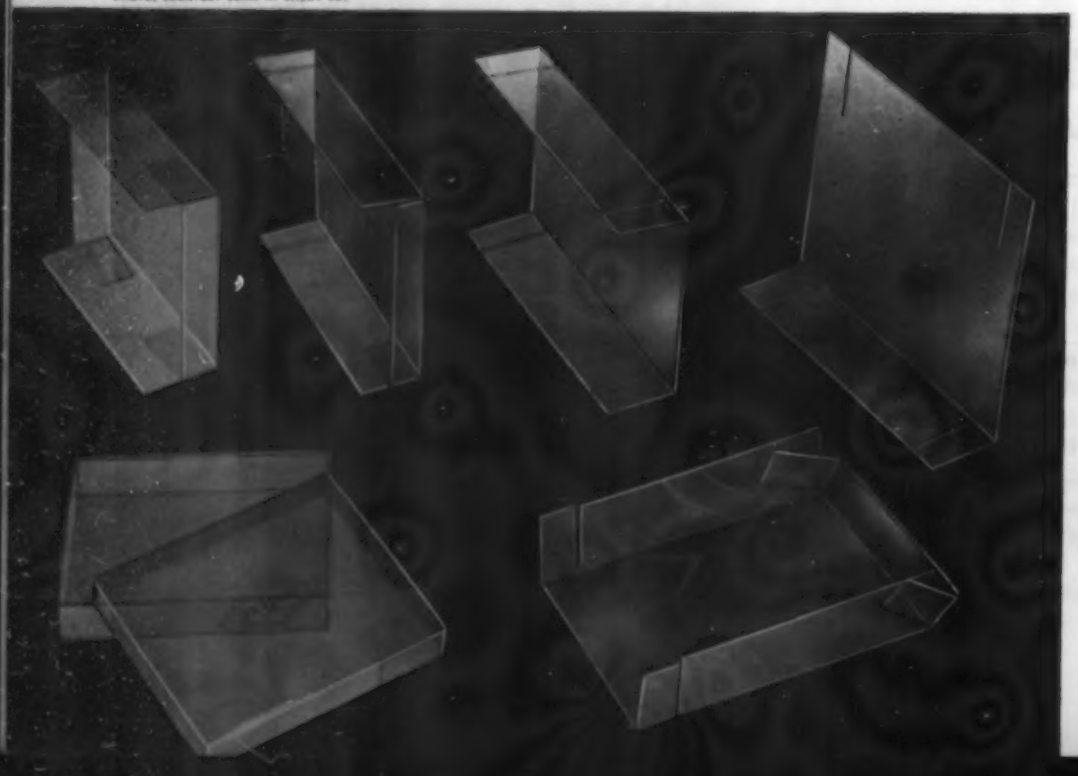
The Plax Corp., Hartford, Conn., was probably the first to develop a simple means of finding the degree of residual strain. Its kerosene test consists of selecting a representative piece of the polystyrene material, immersing it in kerosene for 1 min. at room temperature (20° C. ± 5°), then removing it without wiping, and observing the result. If the piece is free from cracks at the end of 30 min. after its removal from the kerosene, the annealing is satisfactory. This applies only to such small pieces as will not receive or require any subsequent machining.

In the case of long rods, a crosswise sample is cut from the rod and four small holes are drilled through the sample in the axial direction. These holes may vary from $^1/_{16}$ to $^1/_8$ in. in diameter. The operations of sawing out the specimen and drilling the holes should be done with a wet saw and with wet drills to avoid intro-

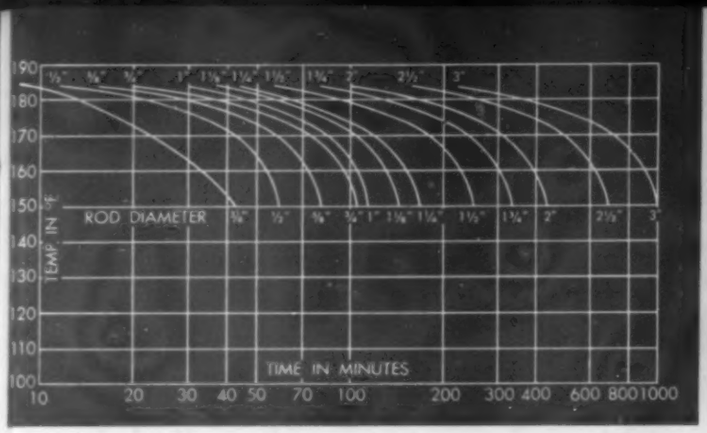
[3] "Rigid folded vinyl and acetate boxes," Modern Plastics 23, 112–113 (June 1946).

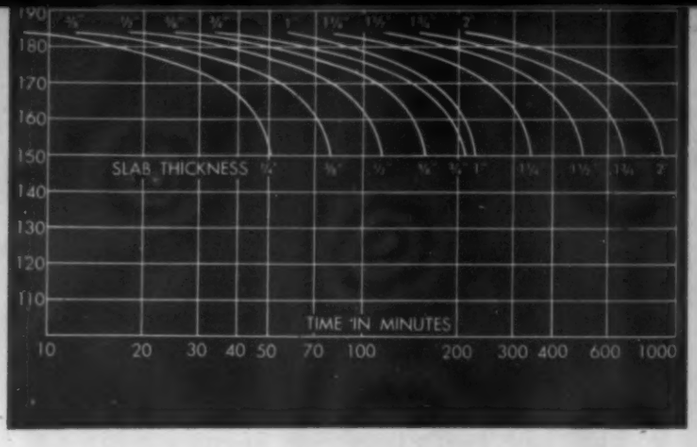
[4] "Annealing of styrene and related resins," Modern Plastics 24, 127–131 (Oct. 1946).

PHOTO, COURTESY JOHN H. OXLEY CO.



5—A minimum of handwork, speed of production and reinforced sides are advantages of this method of constructing boxes from acetate and vinyl sheet





CHARTS, COURTESY PLAX CORP.

6—Above (left) A chart showing standard annealing cycles for round polystyrene rods. 7—Above (right) Here are shown the approved and tested annealing cycles for molded slabs in a variety of thicknesses

duction of strain by these operations. Observation of the results is made very much easier if the saw cuts are filed off with a wet file or if they are ground off with wet sandpaper.

For production purposes and for pieces under 1 in. in diameter, one hole at the center and one about halfway out are sufficient. Small cracks around the ends of the drilled holes or along the saw cuts which show no tendency to spread into the main body of the material are due to drilling and may be disregarded. If the sample indicates deep body cracks, even though small, a second test should be made using more care during the preparation of the sample. If this cracks, the annealing is not satisfactory.

Procedure and equipment—Plax annealing is done in a water bath which is circulated by a propeller and which is temperature controlled by an automatic cycle controller. The tank contains two sets of internal coils of copper pipe—one for steam which is the heating means and one for cold water which is necessary to force the cooling of the tank in the short cycles. The controller is held to its cycle by a master cam which has been laid out to give the desired cycle. When the end of the cycle (150° F.) is reached, the rods are removed. A new load may be placed in the tank at once and allowed to heat up with the bath or the bath may be started up and the rods placed in at some higher temperature. The new charge of rods and the holding rack will drop the temperature of the bath somewhat and the cycle controller must not be started until the charge and bath are in equilibrium at 184° F.

Preventing warp and spicules—Because of orientation strains, there is a tendency for the rods (especially those of $^3/_4$ in. and under) to warp. As a means of preventing this, the rods may be packed in a metal slat rack which allows them very limited motion and keeps them straight during the annealing process. It is loaded outside the tank and handled in and out of the tank by a small hoist.

Annealing cycles for rods and slabs—The standard Plax annealing cycles are given in graph form (Figs. 6 and 7). Ordinates are bath temperature in ° F., abscissas are elapsed time in minutes from the initial equilibrium temperature of the bath at 184° F. These cycles were worked out by the Plax Corp.'s Physical Laboratory and have been tested and found satisfactory over a number of years. They are designed to give the shortest possible time for the required degree of annealing with a computed safety factor of 2. The cycle consists of four divisions: a) the holding time at 184° F, b) the initial slow cooling rate 184 to 170, c) the next slightly faster cooling rate is from 170 to 160, d) the final slightly faster cooling rate 160 to 150. At 150 the parts are removed and then allowed to air cool.

Theoretically, the time required during any of these cycles will vary as the square of the diameter or thickness if the stress at the center is kept constant. Hence any other cycle can be derived very simply if any one of them is known. It can be noted, however, that the cycles for 1 in. diameter or thickness and less are gradually lengthened over what would be required by the square law. The reason for these departures is that the bath cannot be made to follow faster cycles with accuracy and that small temperature lags in the cycles for less than 1 in. diameter require a somewhat greater factor of a safety.

Parts machined from annealed stock—Machining strains in parts made from annealed stock are usually confined to a comparatively thin layer of material immediately adjacent to the machined surface. The annealing consists of removing the strains in this surface layer only and large body strains are not involved. A simple heating cycle of only short duration is all that is required.

The system that the Plax Corporation devised to do this work consists of a small tank stirred by a small propeller, the temperature being accurately held at 182 to 184° F. by a thermostatically controlled electric heater.

Baskets are made of $^1/_4$ in. mesh wire screen into which the machined parts are loosely piled. The whole is lowered into the bath so that it is covered by at least 1 in. of liquid and allowed to remain for 20 minutes. It is then lifted into the upper part of the tank so that its bottom is about 1 in. above the liquid and allowed to drain for 20 minutes. It is then removed and allowed

to cool in the air until all parts have cooled to a temperature of 150° F. or below.

The tank level should be maintained and, because of the rapid evaporation of water at 184° F., ethylene glycol is usually more convenient. If used, the parts must be carefully washed to remove all traces of glycol as this is not a very good electrical insulator and does not dry readily from the parts. Swishing the baskets in several changes of warm water (about 140° F.) will usually remove the glycol satisfactorily.

Conclusions—The primary source of deep body cracks which have been a large factor in erratic behavior of polystyrene parts in service are thermally induced cooling strains which can be satisfactorily removed by an annealing process.

There are many other factors which set up similar strains in the material and cannot be overlooked. Its high coefficient of expansion (10 to 15 times that of steel), its low long-time strength, its susceptibility to various chemical and vapor solvents greatly increase the necessity for annealing but at the same time introduce problems which should be carefully considered prior to actual application.

Metal coating by vacuum evaporation[1]

Many of the developments during 1946 represented the applicaton to civilian goods of processes that had been worked out during the war. A case in point was the use of vacuum evaporation to apply metal coatings to the surface of both plastic ornamental and utilitarian articles. This method of metal coating had been established during the war years for the coating of glass optical surfaces with both low-reflecting materials such as magnesium fluoride and with metals such as aluminum, silver, gold, rhodium and chromium for use as front-surface reflectors.

The more commonly encountered metals including aluminum, copper, gold, silver, chromium, cadmium, zinc, nickel and tin can all be evaporated without serious difficulty. Platinum, rhodium and palladium, however, require special techniques.

The finish of the metal coating depends entirely on the finish of the plastic to which it is applied. Coatings of aluminum and silver on ordinary sheet methyl methacrylate give very good mirror surfaces. Metals deposited on molded plastics likewise exhibit high gloss and brilliance and need no buffing.

Since the coating is formed by molecules condensing from the vaporized state, the film very closely follows the contours of the object. Stampings and indentations are evenly coated, the metal showing no tendency to fill up fine engravings. Very sharp masked areas can be obtained by use of suitable masks.

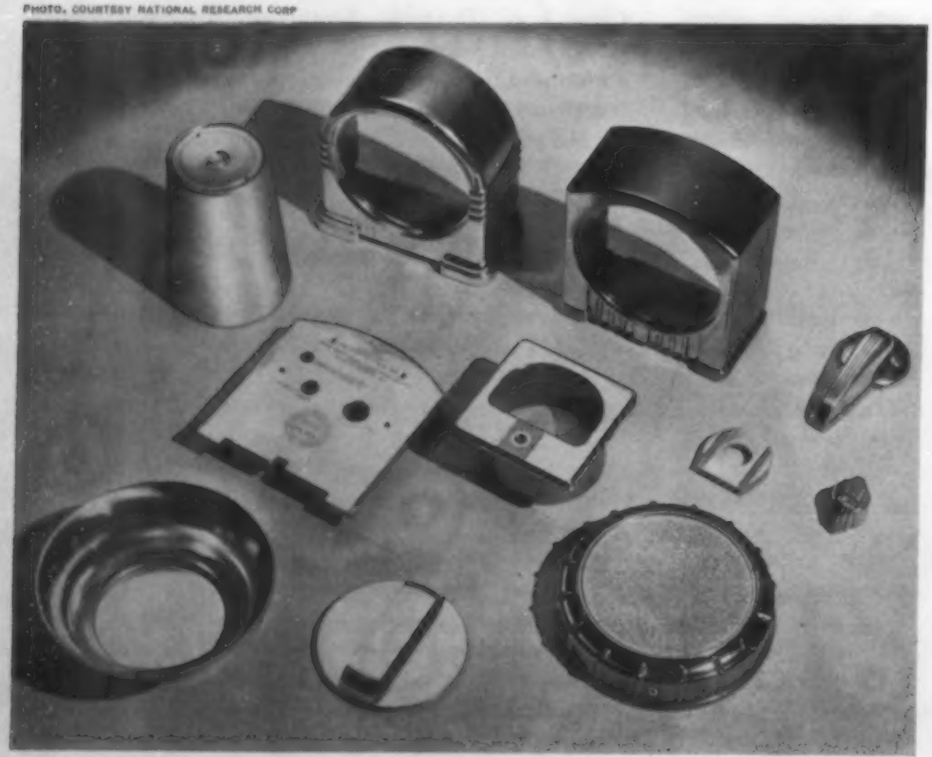
In general, no pretreatment of the plastic is required other than that necessary to insure the plastic being free from oil, grease, dust or other extraneous matter. In some cases, special pretreatment may improve the adhesion of the coating or impart other qualities.

The entire range of plastics to which this process can be successfully applied has not yet been thoroughly explored. Successful coatings have been applied to methacrylate, polystyrene, butyrate and some types of acetate plastics (Fig. 8).

The process—The vacuum evaporation process itself is relatively simple and when used with properly designed and engineered equipment offers no serious production problem. The metallizing is done in an en-

[1] "Metal coating by vacuum evaporation," Modern Plastics 23, 110-111 (Feb. 1946).

PHOTO, COURTESY NATIONAL RESEARCH CORP



8—The vacuum evaporation method of applying metal coating to plastic surfaces works well for decorative, utilitarian as well as industrial articles

closed tank or chamber which has been evacuated to an absolute pressure of 10^{-4} to 10^{-5} mm. of mercury. The articles to be coated are placed in the chamber in racks or jigs at a distance of several inches from a filament, or filaments, from which the metal is evaporated.

The construction of this filament varies according to the particular metal being evaporated. It may be a coiled tungsten or molybdenum wire on which the metal to be evaporated is wound as wire. In other instances, boat-type containers of molybdenum or tungsten afford the means of evaporating the metal which may be in the form of pellets, granules or in any other readily available shape.

The filament is heated electrically until the temperature of the metal to be evaporated is raised to a point where its vapor pressure attains a value of approximately 0.01 mm. of mercury. At this point the metal evaporates at a rate sufficiently rapid to cover the articles with an opaque coating in a period of a few seconds.

Normally, the coating time is short enough so that the plastic does not warm up to a temperature which will cause it to distort or will damage it. Some of the more highly plasticized plastics do, however, present problems because of a tendency to outgas badly. This results in an undesirable rise in pressure in the coating chamber.

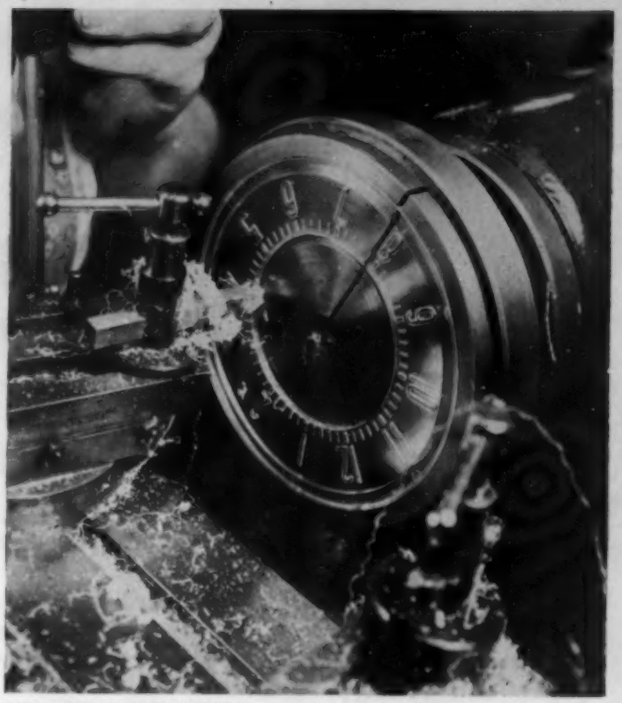
Machining with diamond tools[6]

Machining of plastics also came in for a share of attention. There was discussion of the fact that properly designed diamond tools, when used judiciously, do not increase machining costs since they can do machining at the same time that they finish the plastics parts. Dimensions can be held within very close limits and a very fine finish can be obtained (Fig. 9).

A diamond tool is the same as any other cutting or shearing type tool except that a real diamond forms the cutting head. The stone is shaped by having its outside contours cut down to flat facets on a diamond lap. This shaped stone is then mounted in a steel shank to form a tool bit. The mounting process is secret. However, it is believed that the holder or shank is first milled out to receive the stone and that the stone is held in position. The final operation involves finishing the holder to blend with the facets on the stone.

The distortion that sometimes results from machining is due to the heat generated by most tools. Since diamond tools generate almost no heat, thermoplastics can be safely machined without the aid of a coolant.

It is well known that a machining operation on the outer surface of a phenolic part will cause a loss of strength due to the removal of the surface resin. However, this loss has been found to be much less when a diamond tool is used than when steel tools are employed. The reason for this reduction in strength is quite clear. A cut made by a tool that has a sharp V-point results in V grooves in the material. However, a cut made by a diamond tool will result in a perfectly flat and smooth surface.



PHOTO, COURTESY BOONTON MOLDING CO.

9—Plastic parts can be machined and finished in one operation if diamond tools are used properly and carefully

Various factors to be thought of when considering use of diamond tools are that they are more expensive than steel tools and, when broken, must be returned to a diamond tool company in order to be resharpened or reset (making it necessary for spares to be carried in stock). Then, too, it is not practical to use a high precision cutting tool unless high precision cutting equipment is made use of. For this reason expensive equipment must be installed if the precision results and high finish obtainable from the use of diamond tools is to be expected.

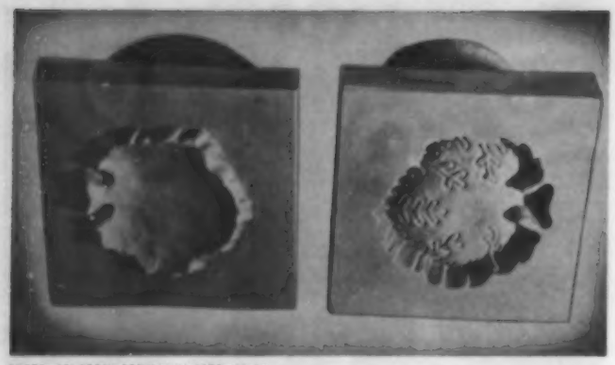
Where the production is low, diamond cutting operations may not be practical. However, in large production where close dimensions must be maintained, diamond tools will tend to lower the final cost by a considerable extent. These tools have an important place in the finishing of plastics and, with proper care and use, they will outperform any other tooling material and they will produce a finish at least comparable to an original molded surface.

Beryllium copper as a mold material[7]

Cost is an important factor in mold making. This is particularly true in the manufacture of decorative and novelty parts where the demand is constantly changing and the need is for an unusually large number of different molds, many of which will be used for rather short runs (Fig. 10). (*Please turn to next page*)

[6] "Machining with diamond tools," by Richard Maxfield, MODERN PLASTICS 23, 131–135 (March 1946).

[7] "Beryllium copper as a mold material," by Lawrence F. Boland, MODERN PLASTICS 23, 139–142 (Feb. 1946).



PHOTO, COURTESY BERYLLIUM CORP. OF PA.

10—*Pressure-cast beryllium copper molds, like these for a small ash tray, are inexpensive to make and maintain*

Beryllium copper has two distinct features that make it attractive for molds of this type:

1. Unlike steel, the 2 to 3 percent beryllium-copper alloys, when properly handled, can be readily cast in sand, plaster, centrifugally, by the lost wax method or by the pressure-casting procedures.

2. As is now fairly well known, the beryllium-copper alloys can be hardened by a relatively simple 2-step heat treatment to hardnesses equivalent to those of medium carbon and alloy steels. Thus beryllium-copper molds will stand up under any of the pressures used in the various types of molding and yield a good production run without appreciable wear.

Pressure-cast or hot-hobbed beryllium-copper cavities offer any one or combination of the following advantages to molders of plastic materials and of rubber goods:

1. Low initial cost of molds.

2. Maintenance of mold costs is kept at a minimum because an insert cavity, if damaged while in production, can be replaced at once by low-cost spare cavities kept on hand.

3. Beryllium-copper cavities can be heat treated to as high as 44 to 47 Rockwell C.

4. Cavities made by this process are degrowthed and of close grained construction.

5. Thermal conductivity of beryllium copper is twice that of steel. Therefore, where 2-cycle molding is being done, production can be stepped up.

6. Beryllium-copper cavities may be hard chrome plated if unusual circumstances make this desirable.

7. Cavities that are practically impossible to hob in steel can be produced by this process.

8. Intricate designs and irregular parting lines, and cavities with mold projections are no problem.

9. The compressive strength of beryllium-copper cavities made by this process is greatly increased.

10. Cavities are produced from master dies. Therefore, where multiple cavities of exact likeness are required, the cost is much lower than when steel is used.

11. When only a few cavities are required, the master hob does not have to be hardened.

12. Tolerances can be held to ±0.001 in. on most cavities.

13. Cast iron master dies can be used on some jobs, reducing the cost of master dies.

Plastic molds for electronic vulcanizing[5]

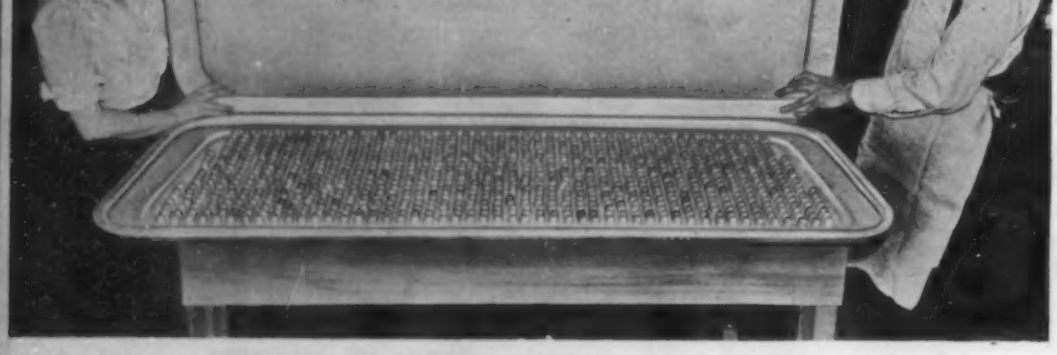
Besides improvements in mold materials for plastics there was the introduction in 1946 of plastics as a mold material for the electronic vulcanization of synthetic and natural rubber.

One of the chief problems on the development of this method of speeding the processing of the rubber into shapes and contours concerned mold materials. Conventional vulcanizing methods make use of steam heat and metal molds. But, because metal is not a dielectric, metal molds cannot be used in the electronic process.

Wood plywood and other dielectric materials were tried out as molds, but low pressure plastic laminates,

[5] "Plastic molds for electronic vulcanizing," MODERN PLASTICS 23, 142-145 (July 1946).

PHOTO, COURTESY OWENS-CORNING FIBERGLAS CORP.



11—*The dielectric properties of resin impregnated glass fabric makes it suitable for use as molds in the electronic vulcanizing of synthetic and natural rubber. Here, with pins in place and cover trimmed, a mold is ready for the production process*

PHOTO, COURTESY LESTER-AETNA DIE CO.

12—A vertical acting mold has been developed for use in a standard injection machine. Here, the movable platen has been withdrawn causing the 2 sections of the mold to move on a vertical plane

with alternate layers of Fiberglas fabric and mat as the base, were found to work out most satisfactorily. In addition to being dielectric, the resin impregnated glass fiber fabric molds possess other essential properties including high tensile and impact strength, light weight, dimensional stability and high temperature resistance.

Aside from savings in curing time, a great advantage of the electronic process is that instead of heating the rubber object slowly and unevenly from the outside in, as in the steam process, the electronic process heats the entire object evenly and in a matter of seconds or minutes. To assure such uniform heating, it is important that the mold heat in step with the rubber—that each have approximately the same loss factor. If the mold heated more quickly or more slowly than the rubber, it would tend either to over-heat or cool the outside of the object being cured. The resin impregnated glass fiber fabric molds heat at approximately the same rate as their rubber content.

The light weight of the Fiberglas-plastic molds, as compared with the weight of metal molds, greatly simplifies handling. The molds are easily formed to complex contours and stand rough handling (Fig. 11).

Very recently a resin impregnated glass cloth mold for a full-sized bed sponge rubber mattress was tested—the largest mold ever made for sponge rubber. Cure time was one-tenth of that required with the steam process and the quality of the mattress was much improved. Sponge rubber automobile seats and cushions have also gone into production using resin impregnated glass fiber fabric molds and electronic method of vulcanizing.

A new mold base[9]

There have been a number of new designs and arrangements of molds during the past year. For example, a new mold base to expedite molding of plastic products and cut costs was developed by Detroit Mold Engineering Co., Detroit, Mich. This base features:

1. Return pins (4 in number) are installed directly in line with leader pins;

2. Dowel pins are completely eliminated in the cavity retainer plates;

3. There is more working space for location of water cooling lines and core pulling devices.

Made in 9 standard sizes, the base can, on special order, be obtained in any size.

Vertical acting injection mold[10]

Yet another departure in mold construction is a vertical die attachment made available by the Lester-Aetna Die Co. of Warren, Ohio, for all Lester injection machines. This is a vertical acting mold, both halves of which move at the same time. In this new attachment, the mold sections are not mounted on the platens as can be seen in Fig. 12. They lie horizontally between the platens, suspended by four toggle arms, two on each side, which have one end pivoted to the mold section and the other end pivoted to the stationary side plates of the die attachment. The operation is as follows:

When the attachment is in the open position (Fig. 12) the movable platen has swung the two sections of the mold on their pivoted toggle arms, separating them and moving one of them up and one of them down on the vertical guide pins which direct their movement. Both mold sections move, a feature not possible with the usual horizontal mold operation. In this open position the safety gate is opened automatically and the molded part can be removed.

When the movable platen travels forward, the halves of the mold approach each other, make contact and are wedged tightly together under enormous pressure. The mold is then ready to resist the shock of injection. The injection load is sustained by a specially designed wedge lock which removes strain from toggle arms.

Magazine molding and how it is done[11]

A unique system of compression molding, the "magazine" method, is in use at Alden Products Co., Brockton, Mass. Method involves cylindrical molds which move vertically in a compression-like piston. Each press complement of seven or eight molds has a spare which can be used in case of trouble. Woodflour

[9] Modern Plastics 23, 186 (June 1946).

[10] "Vertical acting injection mold," Modern Plastics 24, 200 (Oct. 1946).

[11] "Magazine molding and how it is done," Modern Plastics 23, 144–145 (Feb. 1946).

filled phenolics are the principal materials thus far employed, although recently quite a bit of work has been done with low-loss electrical material. Thus far the method has been used chiefly for radio components.

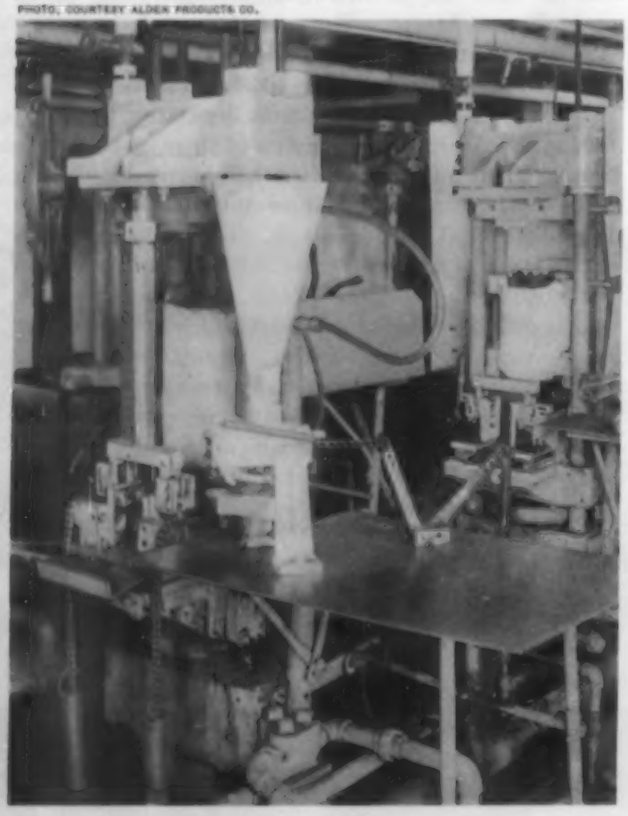
The most important advantage claimed for this system is that the pressure needed to mold eight pieces in unit molds in a vertical line, one on top of the other, is one-eighth the pressure needed to mold them if they were laid out horizontally in a multiple cavity. This means that a smaller press can be used than would be practicable were the same number of cavities laid out horizontally. If a cavity is damaged, work can go on without the long down time occasioned by patching a cavity in a multi-cavity mold or running empties.

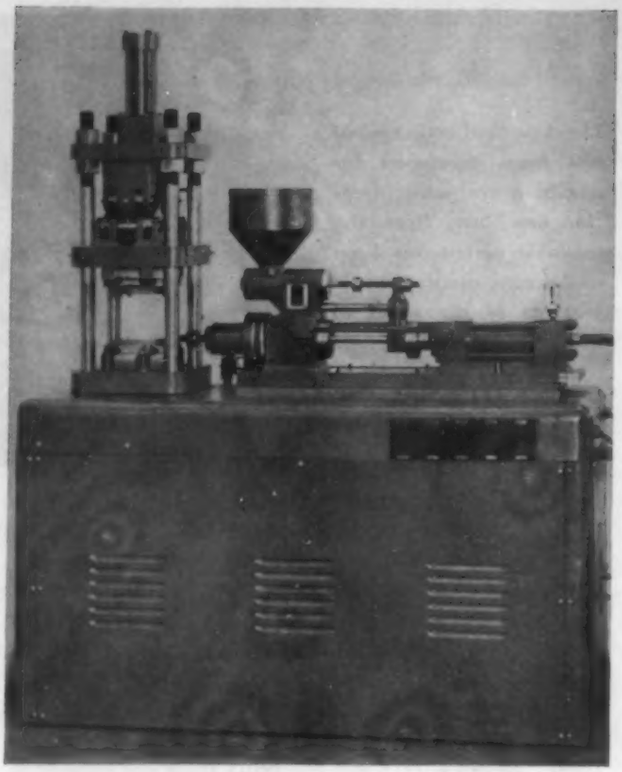
Each magazine holds seven or eight unit molds—depending on the height of each mold—one resting on the other. The operator, fits the center female section of the mold on the mold base and places it under the spout or spouts of the conical hopper for loading (center of Fig. 13). The male top section is then fitted into position, and the assembled mold, loaded with material, placed over the last mold at the top of the cylinder (Fig. 13). Pressure released by a foot pedal sends the ram up into the magazine and at the same time lifts a cured mold (previously ejected to the jig at the front of the machine) up into the jig for emptying.

While the partial cure of perhaps a quarter of a minute is taking place, the mold in the opening fixture is emptied and placed below the hopper, ready for filling. Then the ram drops and the bottom or finished unit mold is pushed forward into the fixture. The six or seven remaining molds in the cylinder drop one stage, the new filled mold going in at the top again. Thus, cure time is the period it takes a unit mold to go from the cylinder magazine top to the bottom.

13—*Pressure requirements for molding a number of parts simultaneously can be reduced by mounting molds one above other in specially constructed magazine press*

PHOTO, COURTESY ALDEN PRODUCTS CO.





14—*A laboratory machine that can operate as an injection, compression or transfer unit, or as a combination*

Naturally, "magazine" molding has its limitations. It is not recommended for tremendous runs. Since all pieces on one press must run on the same cycle for economical production, a large piece with particularly heavy section will have to be handled by individualizing one press or by running the piece through twice.

Versatile laboratory press[12]

Presses, too, have undergone some changes in the past year. Of interest is the laboratory size molding machine, Fig. 14, which can operate as an injection, compression or transfer unit, or as a combination, that was announced by Improved Paper Machinery Corp., Nashua, N. H. This machine is equipped with a vertical clamping unit in conjunction with a horizontal injection unit. Contained in the vertical unit is a compression ram which operates up through but independently of the stationary die platen. The mold clamping is accomplished by a hydraulic toggle mechanism.

The clamping pressure is 25 tons and when using a $1^1/_{16}$ in. plunger, the injection pressure is 22,000 p.s.i. The capacity is $1^1/_2$ oz. of acetate and 1.2 oz. of styrene.

[12] Modern Plastics 23, 208 (Feb. 1946).

Telex Monoset manufactured by Telex, Inc.

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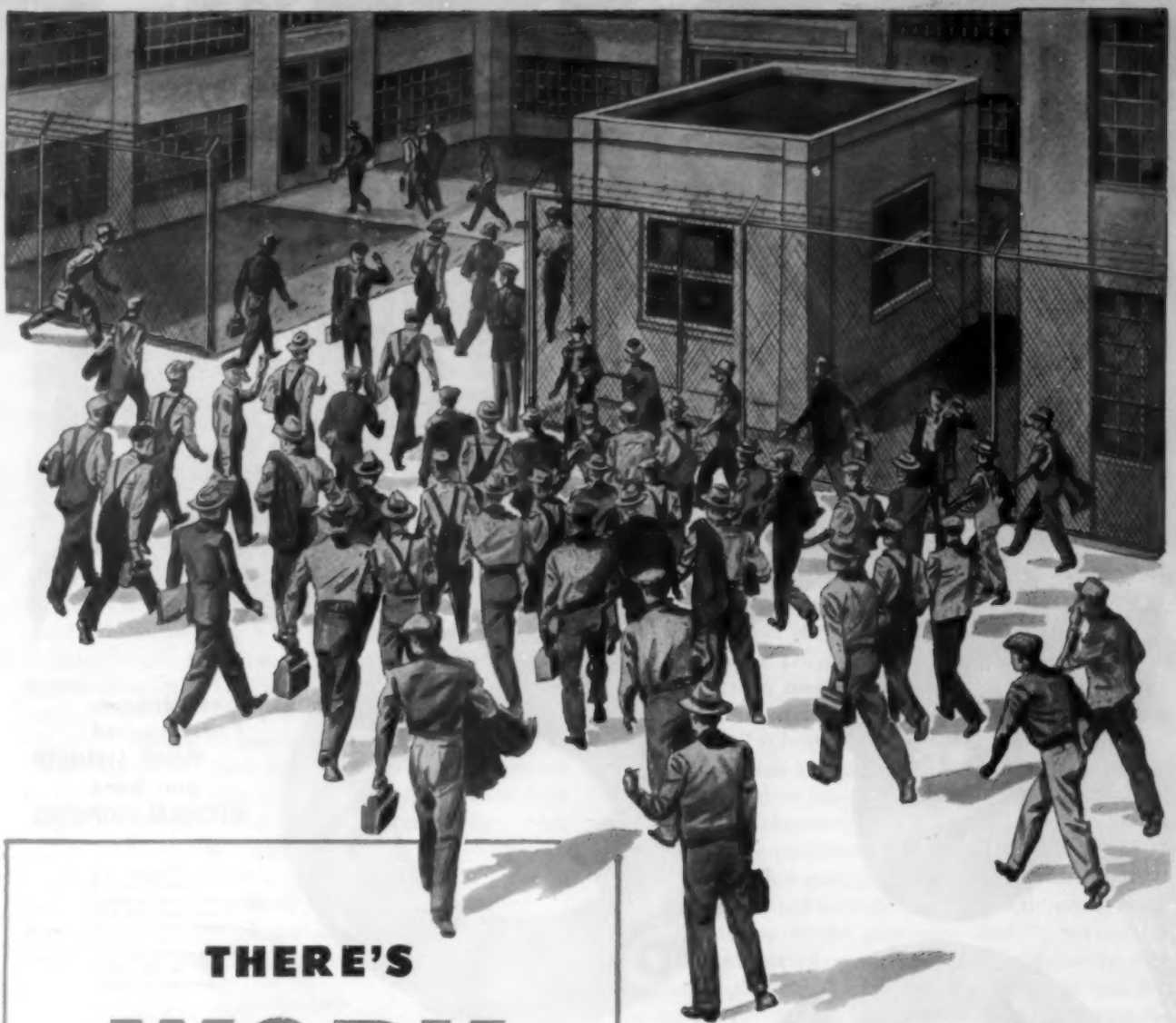

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Advances in plastics during 1946

THE tempo of progress in plastics in this first year of reconversion has been governed to a large extent by the supply situation. Those materials which had well established markets before World War II have been in the main channeled back into these fields. The plastics for which plant capacities were greatly expanded during the war period to meet special military needs have found new uses in a materials starved market. The war-born materials have been undergoing rapid evaluation and modification to meet ordinary commercial requirements.

One significant fact does stand out in the record of 1946. The plastics industry expects to go on from its phenomenal wartime growth to conquer new fields and set new records. Current and planned expansions in production facilities are indicative of this. So also is the continued growth of the literature pertinent to this field. The review for 1940 had 42 references; 1945 had 287; this year there are 411 references.

Materials

A new industrial resin, polytetrafluoroethylene,[1-3] was announced during the year. This material is inert to all types of chemicals except molten alkali metals. It does not have a true melting point but does undergo a solid phase change at 620° F. with a corresponding sharp drop in strength. It gives off small amounts of fluorine-containing gases above 420° F. Because of its high softening point it can be shaped only by special techniques. Suggested applications include coaxial cable spacers, valve packings, gaskets, and plug cocks and tubing for chemical plant equipment.

Last year's newcomer, cellulose propionate, continues to be the subject of exploratory work to determine its particular niche.[4] High surface luster, shorter injection cycles and ability to follow butyrate material in an injection machine because of compatibility with it are among the important observations reported on the basis of field experience. Other advances in the cellulosic field include an improved flame-resistant acetate[5] and alkali-soluble cellulose ethers for application to cotton fibers to impart improved wearability, launderability and shrink resistance.[6, 7] The properties of 38 grades of regenerated cellulose film were reported.[8]

Developments in allyl and polyester resins were described in several reports.[9-12] The formulation of these resins to obtain desired handling and curing characteristics and to promote optimum strength and stability properties in the finished products is being investigated in various industrial laboratories. Consequently, new products of this type are appearing on the market in rapid succession.

The silicone polymers appear to be headed toward applications in many branches of industry, including laminates,[13] electrical insulation[14, 15] radio,[16] protective coatings,[17, 18] lubricants[19] and rubberlike products.[20-22] The preparation and properties of polymethylsiloxanes were described by one author.[23] Numerous reviews of the synthesis, characteristics and applications of silicone polymers were published.[24-27]

The available forms, properties and fabricating techniques of polyethylene were described with special reference to its use in the packaging field.[28] Several investigators reported on the effects of temperature, molecular weight and solvents on the structure and behavior of polyethylene films.[29-32] The field was reviewed by two authors.[33, 34]

Modification of the properties of polystyrene by the use of substituted styrenes or copolymerization is of great current interest. The properties of resins made from dichlorostyrenes,[35] dimethylstyrene[36] and other alkyl derivatives of styrene[37] were described. Developments in the use of various copolymers for injection molding,[38] rubber compounding[39] and surface coatings[40] were reported. Polystyrene itself continues to be outstanding in the high frequency insulation field.[41]

Advances in the technology of the vinyl resins were covered in articles pertaining to the compounding and fabrication of sheeting[42] and the use of dispersions in water (latex)[43] or organic non-solvents (organosols)[44] for application to paper or textiles or for the preparation of films. The chemical structure of polyvinyl alcohol was investigated;[45] this polymer was found to be useful for lining sandblasting cabinets.[46] Copolymerization of 95 parts ethyl acrylate and 5 parts chloroethyl vinyl ether was found to yield a vulcanizable elastomer possessing superior resistance to oils and heat.[47]

Uses for alkyd resins in the chemical industry,[48] adhesives,[49] electrical insulation[50] and protective coatings[51, 52] were reviewed. Techniques used in the pro-

duction[53] and fabrication[54] of nylon resins were described. Other reports of progress in the synthetic resin field related to furane resins,[55, 56] ion exchange resins,[57, 58] and petroleum[59] and coal tar[60] as sources of the plastics.

The trend toward attainment of desired properties in polymers by copolymerization is also reaching over into the condensation resin field. Mixtures of phenolic resins and synthetic rubbers are being used to impart greater toughness to compression molded products[61] or to speed up cure and improve the chemical and heat resistance of rubber stocks.[62–64] Combinations of rubbers and vinyl resins are also being investigated.[65] Various derivatives of natural and synthetic rubbers represent promising materials for many applications.[66, 67] A resin derived from acetylene and phenol is useful as a tackifier for GR-S.[68]

The use of animal and vegetable products as raw materials for the plastics industry was covered in numerous reviews.[69–72] Special treatment was given to the preparation of a plastic composition from leather [73, 74] and fibers of zein from corn [75] and of alginic acid from seaweed.[76–78] Derivatives of casein,[79] starch[80, 81] and lac[82] were prepared and evaluated. The separation of lignin from lignocellulose[83] and its use in plastic compositions[84, 85] were investigated. Compositions prepared by incorporating agricultural residues in phenolic molding compounds[86] and shellac in rubber stocks[87] were studied. Consideration was given to the improvement of the water resistance of proteins by treatment with various reactive organic chemicals.[88]

New plasticizers for vinyl resins were reported during the year. One of these is a petroleum hydrocarbon product, characterized by cheapness and compatibility but relatively volatile;[89] another comprises a group of ether esters of fatty acids, including those derived from corn and cotton seed oils.[90] Discussions of fillers for plastics included the use of acetylene black to promote electrical conductivity[91] and cocoanut shellflour to give improved finish and greater heat and water resistance.[92] A comprehensive survey was made of the fungal susceptibility of resins and plasticizers and the degree of protection afforded by the incorporation of various fungicides in plastic compositions.[93] The protection of surface coatings with fungicides was also considered.[94]

A review of recent developments and applications of high pressure laminates highlighted the trends in that branch of the plastics industry.[95] A comparator chart of properties of standard laminates will be a valuable aid to engineers concerned with the selection of materials.[96] Properties of melamine glass-fabric,[97] lignin paper[98] and non-woven cotton web[99] laminates were the subjects of special reports. Methods and equipment for treating paper with resins were described;[100–103] uses for microcrystalline waxes as coatings on paper were also considered.[104]

The Forest Products Laboratory published the results of an extensive investigation of the treatment of wood with urea resin-forming systems. The anti-shrink efficiency of the resulting product was about two-thirds of that obtainable with phenolics at the same resin content.[105] Commercial development of a wood fiber base plastic was announced.[106]

Continued interest in low-density plastics and their application in sandwich structures was evident. Cellulose acetate became available as extruded boards 1/2 to 1 in. thick and 4 to 8 lb./cu. ft. density.[107] Honeycomb core materials were prepared from resin-impregnated paper and glass cloth.[108–111] Sandwich structures made with such cores are used in the fabrication of aircraft parts.[112–114] Synthetic rubber has also been converted into expanded products.[115, 116] The properties of various low-density plastic materials were likewise determined.[117, 118]

Because of the moisture resistant qualities of polyethylene, the material is now used extensively for packaging

PHOTO, COURTESY VIKING CORP.

German plastics

Reports of industrial developments in German plastics during the war are creating a vast new literature on the technology of plastic products. The materials covered by these articles during the year included polyvinyl alcohol,[119] polyvinyl carbazole,[120] polyethylene,[121, 122] polyvinyl chloride,[123–125] polystryene,[126] resin impregnated laminated wood,[127] and phenolic resins,[128–130] molding compounds[131] and laminates.[132] Special reports related to emulsion polymerization,[133] preparation of plastics from products derived from acetylene[134] and molding and fabricating techniques.[135] Other investigations pertained to vulcanized fiber,[136] protective coatings,[137] synthetic fibers,[138] resin-treatments for fibers[139] and synthetic rubber products.[140–142] Two books summarizing practices in various phases of the German plastics industry were published.[143, 144] As in last year's review, it can again be forecast that the material gathered in these investigations will con-

tinue in 1947 to be a fruitful source of new information on plastics technology.

Molding and fabricating

Especially noteworthy reports were published during the year on techniques of extrusion. One of these related to the production of cellulose ester plastic sheeting in widths up to 24 in. by a non solvent continuous process using a standard extruder.[145, 146] Another concerned the methods found to be best suited for extruding acrylic resin;[147] the same author discussed procedures for annealing polystyrene and other thermoplastics.[148] The fundamentals of extrusion equipment and procedures[149] and the operations involved in the manufacture of fountain pens[150] were also reviewed.

Improved methods and machinery for compression,[151, 152] injection[153] and cold[154] molding were described. The heating of molding powders was considered both generally[155] and specifically with reference to high-frequency preheating,[156] infrared lamps,[157] rotating compartmented oven,[158] steam table[159] and incorporation of graphite for direct resistance heating.[160] The merits of beryllium copper molds[161] which can be cast and hardened, and zinc alloy molds for short runs[162] were recounted. Duplication of molds by the use of manual, electric control and automatic machines was described.[163] Developments in steels for molds were reviewed.[164]

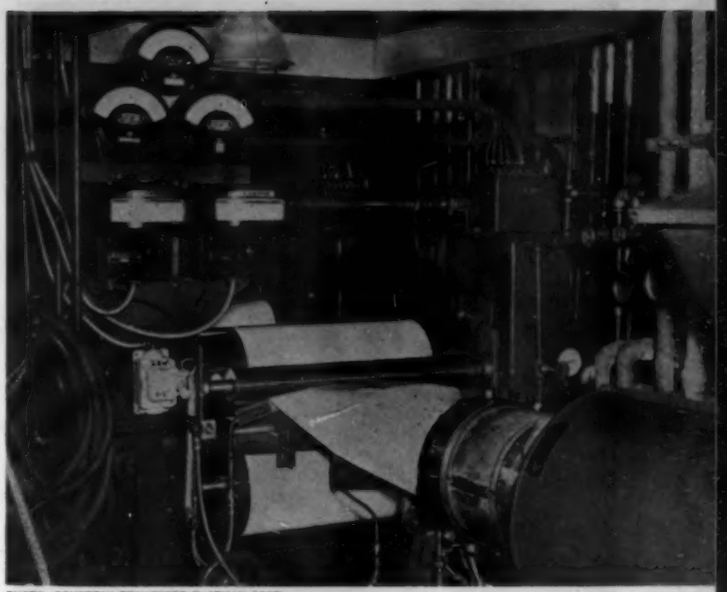
A comprehensive investigation was made of casting and curing techniques and physical and chemical properties of cast plastics.[165] Centrifugal casting of phenolic resins[166] and film casting of vinyl resins[167] were described. Directions were given for the preparation of lead alloy[168] and neoprene[169] molds for casting plastic.

The art of low-pressure molding is still in an intense development stage.[170–173] Rubber bags and blankets are part of the standard equipment used in this process; now the situation is about to be reversed with low-pressure laminated molds, because of their dielectric property, serving in the electronic vulcanization of rubber products.[174] This development promises to cut processing time up to 80 to 90 percent in that industry, just as it has in plastics molding.[175] Recent developments in postforming laminates were described.[176, 177]

Methods and equipment for machining,[178–181] cementing and assembly,[182–184] heat-sealing,[185, 186] polishing,[187] and spray or dip coating[188–190] of plastic products were discussed. A new technique for applying metal coatings to plastics by a vacuum evaporation technique[191] was added to the older established electroplating[192, 193] and spraying[194] procedures. Resinous materials can be applied as surface coatings by a flame spraying process.[195]

Applications

The literature pertaining to uses of plastics reflected the picture of changing markets for the industry's products. Case histories of military items which had dominated the field during the war years were replaced by accounts of developments in luggage,[196] wallpaper,[197]



PHOTO, COURTESY TENNESSEE EASTMAN CORP.

The equipment that has been developed for nonsolvent continuous extrusion of cellulose ester plastic sheeting

flooring,[198] lighting,[199, 200] refrigerators,[201, 202] handicrafts,[203, 204] sporting goods[205] and the like. Industrial utilization of plastics was emphasized in articles dealing with brake linings[206, 207] leather manufacture,[208, 209] printing,[210, 211] oil well operation,[212] sealing castings,[213, 214] production of permanent magnets,[215] electroplating[216–218] and chemical plant equipment.[219–222]

The aircraft industry continues to lead other branches of transportation in reports of new developments and improvements in plastic items. These include windows,[223, 224] flooring and partitions of honeycomb sandwich,[225] vinyl wall coverings,[226] insulation and accessory fixtures,[227] propeller blades,[228] and resin-bonded plywood[229] and glass fabric[230] for structural parts. Various applications of plastics in the automotive,[231, 232] railway[233, 234] and boat construction[235] industries were reviewed.

Plastics are still spoken of hopefully in some quarters in connection with the housing problem, but cost and supply are far out of line with those of the common building materials. Two new developments in this field were described, one a resin-bonded sawdust timber, evolved in Great Britain, for conventional wood applications,[236] the other a honeycomb-core aluminum-faced panel proposed for use in prefabricated housing.[237] Other aspects of plastics in building construction were discussed.[238–240] The plywood industry, which in 1927 used no synthetic resin adhesives, took more than half the approximate 80,000,000 lb. produced in 1945.[241, 242]

A bright future is foreseen for vinyl plastics in the textile field.[243] Civilian applications for these supported and unsupported films include home furnishings, bookbindings, protective clothing, handbags, and upholstery.[244–247] Fabrics woven from polyvinylidene chloride monofilaments are also available as seat cover-

PHOTO, COURTESY FANTASITE CO., INC.

Supported and unsupported vinyl films have created much interest among industrial users and among consumers

ings for severe service installations, such as in public transportation, theaters and hospitals.[248, 249] New developments in resin treatment of fibers were reported.[250–253] One of these concerns a process for bonding short-staple cottons into yarns stronger than those made from expensive long-staple fibers and at the same time eliminating the conventional steps in yarn manufacture of spinning, spooling, warping and twisting. The roving or yarn is impregnated with resin, aged and then passed over a heated grid to cure the resin.[254] Like the non-woven cotton web for laminates previously mentioned,[90] these experiments are directed toward by-passing the costly mill operations involved in textile manufacture.

There was renewed activity in the use of plastics in the packaging field during the year.[255–257] The properties and performance requirements of films and sheeting[258–261] and resin-impregnated paper[262,263] for such purposes were reviewed. Low-pressure molded laminates were used as bottle holders in precision labeling machinery.[264] Processes were described for protecting metal parts and equipment by strippable films of both the spray webbing[265] and hot dip[266] types.

The surface coatings industry continues to take more of the synthetic resin output than any other single group.[267–269] Wood finishes,[270, 271] map protection[272] and formulation of heat-resistant paints[273] were among the special problems considered. Developments in materials included cellulose acetate butyrate gel lacquers for dip coating[274, 275] and vinyl chloride latex.[276] An alternate method of applying a wear-resistant resinous finish on materials as plywood, wallboard and like products is the use of resin-impregnated paper.[277]

The medical profession has found many important roles for plastics,[278, 279] particularly in the prosthetic[280–283] and surgical[284, 285] fields. Other noteworthy applications of plastics described during the year included lenses,[286, 287] armor,[288, 289] electrical insulation,[290–292] inks[293–296] and soil stabilization.[297]

Adhesives

Numerous publications gave evidence of the growing consumption of resins in the bonding of wood,[298–301] metals,[302, 303] rubber[304] and laminates.[305, 306] Specific adhesives made from phenolic resin,[307] shellac,[308] cellulose acetate,[309] starch[310] and peanut meal[311] were discussed. Other authors dealt with properties[312] and testing methods.[313–315]

Properties, testing, specifications

A formula for calculating the coefficients of thermal expansion of mixtures of resins and fillers was published during the year.[316] This is a very significant advance in the art of compounding plastics, because it makes possible the preparation of compositions which will match metal inserts and other reinforcing materials with respect to expansion and contraction as the temperature changes. This serves to prevent stresses from developing in the molded or laminated product and eliminates cracking, loosening of inserts or delamination.

Outstanding contributions were made to our knowledge of the strength properties of cellulose acetate,[317] compreg[318] and paper laminate.[319] An investigation of the correlation of test results obtained with standard specimens and molded parts, respectively, represents a unique addition to the technical literature.[320] Reports appeared concerning impact strength,[321] abrasion,[322] effect of hot forming on mechanical strength of acrylic plastics[323] and flexibility characteristics of N-substituted polyamides.[324]

Numerous papers on the permeability of films to moisture[325–329] and gases [330] and on the fungus resistance of plastics[93, 331–334] followed the lifting of restrictions on publication of the results of these war projects. Other properties reported on include dimensional stability,[335] electrical[336–338] and solubility phenomena,[339] molecular weight and structure of polymers,[340–343] and temperature and humidity effects on fibers and fabrics.[344–346] Two articles were published on dermatological effects of synthetic resins.[347, 348]

Various methods and machines were described for measuring mechanical strength properties of plastics, in particular tensile,[349–351] flexural,[352–354] impact[355–359] and fatigue[359] strength, hardness[360, 361] and abrasion resistance.[362, 363] Other testing methods investigated pertain to the determination of water absorption,[364, 365] water vapor[366–368] and gas[369, 370] permeability of films, distortion under heat,[371] flow,[372, 373] optical distortion,[374] electrical[375] and thermal[376] conductivity, accelerated aging[377] and heat sealing.[378] Special techniques developed for evaluating plastics and other high polymers made use of ultrasonics,[379] *x*-rays,[380] light scatter-

ing,[381–384] radioactive isotopes,[385] deformation rate,[386] osmometry[387] and density gradient solutions.[388]

Analysis and identification of plastics were considered in articles relating to cellulose esters,[389] polyvinyl chloride,[390] casein,[391] phenolic adhesives,[392] alkyds,[393] plasticizers,[394] inhibitors,[395] rubber,[396–398] water content of molding powders,[399] total solids of resin solutions[400] and microscopic structure.[401]

The Society of the Plastics Industry published five booklets pertaining to testing of plastic parts,[402] design of inserts,[403] and molding[403a] tolerances for molding[404, 405], cementing and assembly of plastic products.[183] The American Society for Testing Materials issued three new test methods, prepared by its Committee D-20 on Plastics, for blocking of sheet materials, tensile properties of thin plastic sheets and films, and apparent density and bulk factor of molding powder.[406] Numerous revisions were made in the A.S.T.M. specifications for plastics; their preparation and use were discussed.[407, 408] Current development work in the control of dust explosions and fires in the plastics industry are indicative of its growth and importance from the view of personnel safety and investment security.[409, 410]

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Silicone rubber, used during war as gaskets for searchlights, is here used as a seal for high temperature oven

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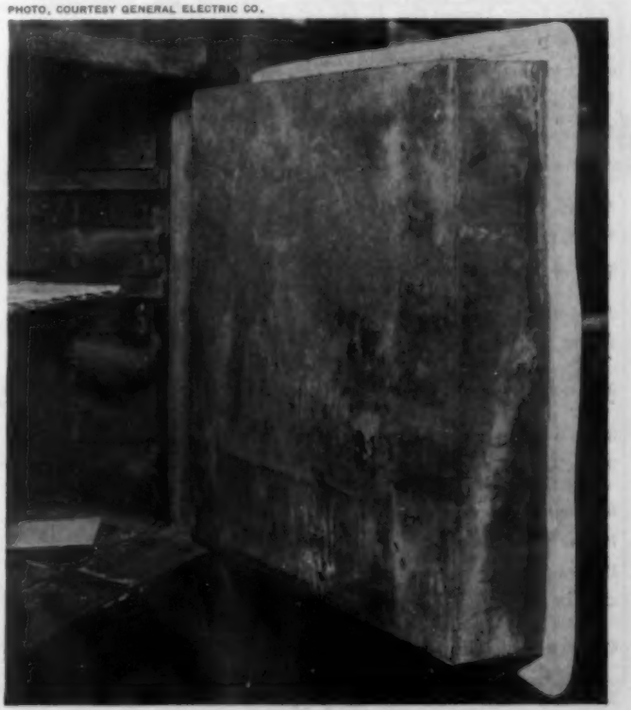

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German plastics

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German manufacture of polyvinyl ethers*

by G. M. KLINE†

Polyvinyl ethers are synthetic resins made by I. G. Farbenindustrie A.-G. for use as lacquer bases, adhesives and impregnating agents for paper and textiles. This report describes the preparation of the methyl, ethyl and isobutyl vinyl ethers and their polymerization.

POLYVINYL ethers were manufactured by I. G. Farbenindustrie A.-G. at Ludwigshafen and Oppau during the war. The peak production was approximately 600 tons per month. The compositions of the various I. G. resins of this type were given in a previous report.[1] The polymers are useful as lacquer bases, adhesives and impregnating agents for paper and textiles.

The monomeric vinyl ethers are made by reacting acetylene under pressure with an alcohol at 160 to 175° C., using potassium hydroxide as a catalyst. The process was developed by Dr. Walter Reppe in the course of his investigations with acetylene as a source of synthetic products.[2]

$$\underset{\text{Acetylene}}{CH{\equiv}CH} + \underset{\text{alcohol}}{ROH} \xrightarrow{KOH} \underset{\text{Vinyl ether}}{CH_2{=}CH{-}OR} \xrightarrow{BF_3} \underset{\text{Polyvinyl ether}}{(-CH_2-\overset{OR}{\overset{|}{C}}H-)_n}$$

This report describes the preparation of the methyl, ethyl and isobutyl vinyl ethers and their polymerization. These three polymers accounted for the bulk of the German production.

Vinyl ether monomers

The production of the vinyl ethers is accomplished by a continuous process at Ludwigshafen.[3] A diagram of the equipment, which is constructed of ferrous metal, is shown in Figs. 1 and 2. The reaction tower is filled two-thirds of its height with catalyst solution. For the methyl ether a 20 to 25 percent solution of potassium

* The Office of Technical Services, Department of Commerce, hopes that the dissemination of these reports will be of direct benefit to American science and industry. The Office does not undertake to edit the reports, nor does it accept the responsibility for the information or opinions contained in them. Interested parties should realize that some products and processes described may also be the subject of United States patents or of patents granted by friendly foreign governments. Accordingly, it is recommended that the usual patent study be made before pursuing practical applications.

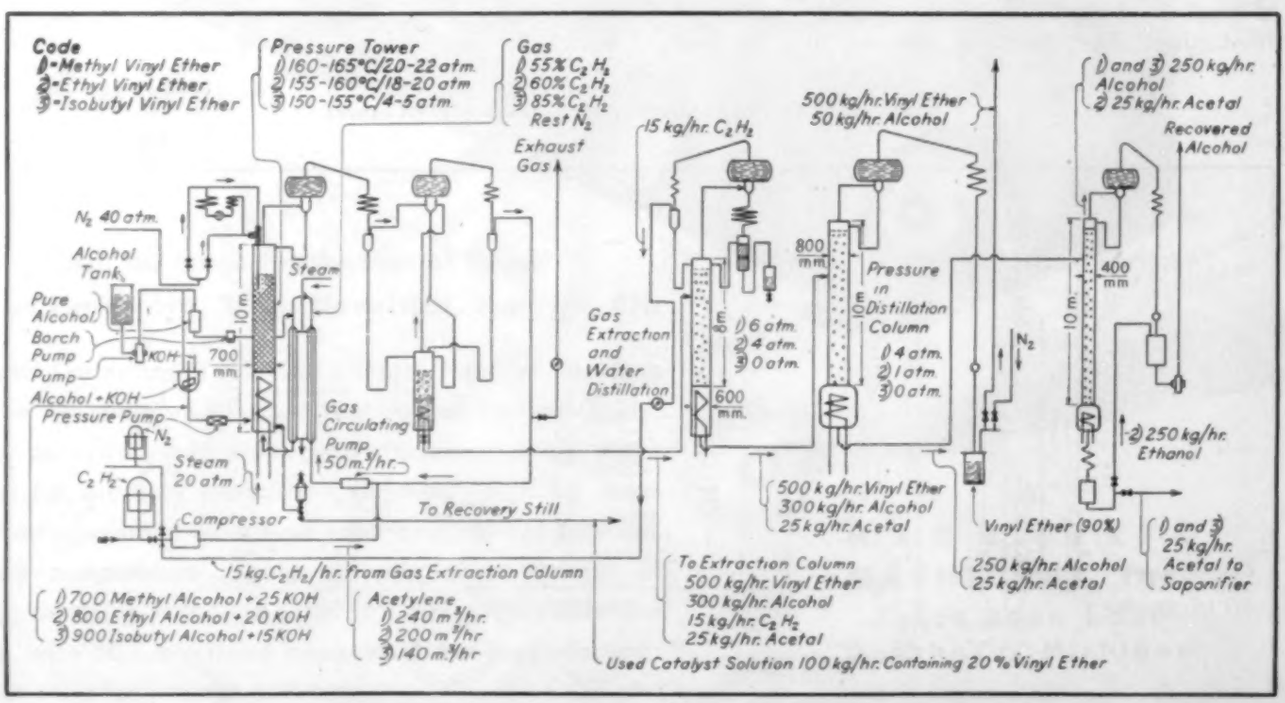
† Chief, Plastics Section, National Bureau of Standards.

[1] "Plastics in Germany 1939–1945," by G. M. Kline. Report PB 28316: MODERN PLASTICS 23, 152A (Oct. 1945).

[2] "Acetylene as the Basis of New Plastics," by W. Reppe. Translation by I. G. Callomon and G. M. Kline. Report PB 2437: MODERN PLASTICS 23, 169 (Feb. 1946).

[3] "Investigation of German Plastics Plants," by G. M. Kline, Ordnance Department; J. H. Rooney, J. W. Crawford and T. Love, British Ministry of Supply; F. J. Curtis, Chem. Warfare Service. Report PB 949.

1—Equipment for the production of monomeric vinyl ethers



hydroxide in methyl alcohol is used; for the ethyl ether a 20 percent solution in ethyl alcohol; and for the isobutyl ether a 15 percent solution in isobutyl alcohol.

During operation an alcoholic potash solution is passed into the tower at the bottom at the following rate per hour:

Methyl ether	700 kg. methyl alcohol, 25 kg. KOH
Ethyl ether	800 kg. ethyl alcohol, 20 kg. KOH
Isobutyl ether	900 kg. isobutyl alcohol, 15 kg. KOH

Some alcohol is also pumped into the gas system to avoid any contact of acetylene with dry potassium hydroxide.

Acetylene diluted with nitrogen is fed into the catalyst solution at the following rate per hour:

Methyl ether	140 cubic meters
Ethyl ether	200 cubic meters
Isobutyl ether	240 cubic meters

For the methyl ether the gas is 55 percent acetylene and 45 percent nitrogen at 20 to 22 atmospheres; for the ethyl ether it is 60 percent acetylene and 40 percent nitrogen at 18 to 20 atmospheres; for the isobutyl ether it is 80 to 90 percent acetylene and 10 to 20 percent nitrogen at 4 to 5 atmospheres. The gas is preheated to 100 to 120° C. and circulated through the system by a pump of 50 cu. meters per hour capacity at normal pressure; the amount of gas passing through the tower can be calculated by multiplying the 50 cu. meters by the pressure in atmospheres.

A dephlegmator at the top of the tower has a cooling surface of 15 sq. meters and is kept at 120° C. The temperature at the bottom of the tower is 160 to 165° C. for the methyl ether, 155 to 160° C. for the ethyl ether and 150 to 155° C. for the isobutyl ether.

The used catalyst mixture is drawn off at the bottom of the tower at the rate of 100 kg. of solution per 500 kg. of vinyl ether produced and contains 20 percent of vinyl ether. The alcohol is recovered from the used catalyst solution in a discontinuous distillation process. Two vessels of 2 cu. meter capacity are used for this purpose to process 1000 kg. of solution per batch. In the case of the isobutyl ether, the solution is first washed with water. Then the azeotrope or constant boiling mixture is distilled, followed by a second distillation to separate the water from the alcohol. Five hundred kilograms of alcohol are recovered from 1000 kg. of catalyst solution. Potassium hydroxide is discarded.

The distillate from the reaction tower contains per hour: 500 kg. vinyl ether (60 percent), 300 kg. alcohol, 15 kg. acetylene and 25 kg. acetals. The acetylene is removed by heating the distillate at 100 to 120° C. with a dephlegmator temperature of about 20° C. (cooling water temperature). This operation is conducted at the following pressure:

Methyl ether	6 atmospheres
Ethyl ether	4 atmospheres
Isobutyl ether	Ordinary atmosphere

The mixture of vinyl ether and water which distills during removal of the acetylene is separated by gravity and the vinyl ether is returned to the column.

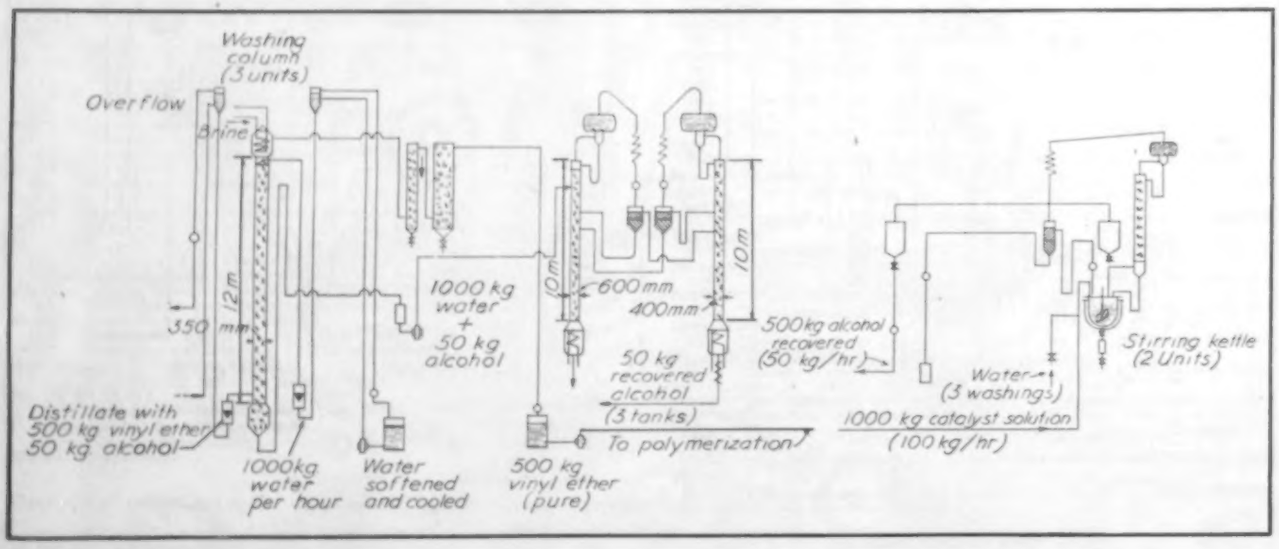
The crude vinyl ether fraction is distilled in a column filled with iron Raschig rings at the following pressures:

Methyl ether	4 atmospheres
Ethyl ether	1 atmosphere
Isobutyl ether	Ordinary atmosphere

The temperatures at the bottom and top of the column are those of the boiling points of the ether and alcohol, respectively.

The mixture of alcohol and acetal is taken from the bottom of the column at the rate of 250 kg. of alcohol and 25 kg. of acetal per hour. This mixture is separated by distillation at ordinary pressure in a column with iron Raschig rings. The recovered alcohol is pumped back into the system. (*Please turn to page 188*)

2—*Equipment for the production of monomeric vinyl ethers*



2 ounces

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This new Higgins cruiser is a stronger, lighter and tighter boat. Why? Because it is being made with waterproof plywood deck panels and molded veneer hulls bonded with waterproof resin adhesives.

These new Cyanamid resin glues hold tight in spite of constant soaking or pounding from heavy seas. The glue is stronger than the wood it bonds. Narrow planking and old-fashioned caulking are eliminated. The boat is ready to sail when completed — no need to worry about leaks or a "swelling up" period.

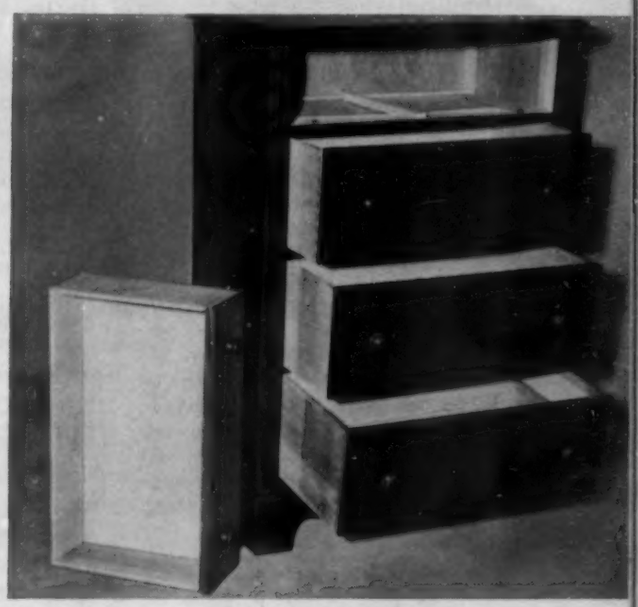
Cyanamid resin adhesives are being used for many other quality products. Prefabricated houses, aircraft, furniture, truck and station wagon bodies, sporting goods, and musical instruments can be made quicker and stronger with these glues.

Certain Cyanamid resin adhesives cut construction time almost in half. They're easy to handle, foolproof, and veneers do not lift or peel. Certain formulations have gap-filling properties — important when perfect fitting is not practical. In many cases, clamping is reduced since only spot tacking is required.

From our complete line of MELMAC, MELURAC, URAC, and PHENAC resin adhesives, a formulation can be made that will speed production and create better acceptance for your product. Consult Plastics Division, American Cyanamid Company, 32 Rockefeller Plaza, New York 20, N. Y.

A 34-foot cruiser made with plywood bonded with Cyanamid's MELURAC resin adhesive 300 by Higgins Incorporated, New Orleans.

AT THE Williams Furniture Corporation's plant in Sumter, S. C., plywood furniture veneers are permanently glued by the hot press method with Cyanamid's URAC resin adhesive 110, because of the durability and water resistance provided. Pure URAC resin 110, mixed with a cereal filler extender, water, and a hardener, is uniformly spread on core veneers by an automatic glue spreader.



PLYWOOD manufactured at the Williams Furniture Corporation plant with Cyanamid's URAC resin adhesive 110 is used in their line of furniture for drawer bottoms, dust bottoms, front, side, and end panels. After the core veneers leave the glue spreader, laid-up assemblies are placed in a multiple-platen hot press, and in a few minutes, the URAC resin adhesive bonds the veneers into rigid, water-resistant plywood.

Technical Briefs

Abstracts of articles on plastics in the world's scientific and engineering literature relating to properties and testing methods, or indicating significant trends and developments.

Engineering

LAMINATED EDGE ATTACHMENT FOR ACRYLICS. E. H. Snyder. Trans. A.S.M.E. *68*, 767–71 (Oct. 1946). An examination of a number of service reports on large acrylic parts such as canopies, astrodomes, turrets, blisters, noses and windshields reveals that replacements are comparatively frequent. Most replacements are necessitated because of crack formations originating at attachment points. The present conventional method of attachment requires the drilling of a considerable number of holes along the edges of the canopy. These holes have to be large enough to permit the installation of rubber grommets and steel liners which serve to minimize the possibility of crack formation. A new and improved method of edge attachment was recently developed which consists of bonding integrally a laminate of relatively high strength to the canopy edges. Attachment can then be made directly through the laminated edge strips without the use of grommets and liners. Until recently the manufacture of such a reinforced edge was not practical. However, with the development of catalysts which promote rapid polymerization or solidification of the methyl methacrylate liquid monomer in the presence of ultraviolet light, the bonding of edge strips to the canopy has become feasible. Pieces of fabric are dipped in a catalyzed methyl methacrylate resin syrup which is made by partially polymerizing the monomer. These wet pieces of fabric are laid on the edges of the acrylic plastic window and the assembly is pressed between cellophane-covered glass plates. On exposure to ultraviolet light the polymerization is completed and the result is a sheet of transparent acrylic plastic with fabric laminate edges. Glass fabric is preferred. Preliminary tests show that this type of attachment is at least twice as strong as the conventional edge attachment. Laminated edging integrally attached to acrylic sheeting consistently approaches and in certain cases develops the full strength of cast acrylic sheeting.

Chemistry

NATURE OF THE CARBONYL GROUPS IN POLYVINYL ALCOHOL. J. T. Clarke and E. R. Blout. J. Polymer Sci. *1*, 419–28 (Oct. 1946). Measurements of the viscosity of polyvinyl alcohol solutions may be correlated with the chemical nature of the polymer. It is shown that polyvinyl alcohol contains 0.4 mol percent carbonyl groups in the polymer chain, which are to some extent present as ketols. The presence of these keto groups is demonstrated by a combination of spectrophotometric and chemical techniques. The carbonyl groups appear to be randomly distributed along the polymer chain and also seem to be independent of chain length. The presence of keto groups along the chain allows an explanation for the behavior of aqueous polyvinyl alcohol solutions with acid or alkali.

Properties

THERMAL POLYMERIZATION OF METHYL METHACRYLATE. C. Walling and E. R. Briggs. J. Am. Chem. Soc. *68*, 1141–5 (July 1946). By the use of suitable precautions, a reproducible polymerization of methyl methacrylate was obtained between 100–150° C. in the absence of added catalysts. This is thought to represent a true thermally initiated reaction with an over-all activation energy of 16 kcal. Combining the data reported here with those of Schulz and Blaschke and assuming a mechanism of bimolecular initiation, growth and termination, the thermal initiation reaction was calculated to have an activation energy of 22 kcal. but a frequency factor of less than unity. The average kinetic chain length is approximately three million in this temperature range, but polymer molecules are much smaller due to chain transfer. The transfer constant for the methacrylate radical with hydroquinone is approximately 0.01.

COPOLYMERIZATION: THE COMPOSITION DISTRIBUTION CURVE. I. Skeist. J. Am. Chem. Soc. *68*, 1781–4 (Sept. 1946). A new method of computation of the composition distribution of copolymers is proposed which permits evaluation of systems containing any number of components.

Testing

DETERMINATION OF POLYMERIC MOLECULAR WEIGHTS BY LIGHT SCATTERING IN SOLVENT-PRECIPITANT SYSTEMS. R. H. Ewart, C. P. Roe, P. Debye and J. R. McCartney. J. Chem. Phys. *14*, 687–95 (Nov. 1946). The theory of scattering by an inhomogeneous dielectric medium has been extended so as to account for the turbidimetric behavior of polymer solutions in solvent-precipitant mixtures. It is predicted by this theory and verified by experiment that correct values of molecular weight are obtained by the usual interpretation of turbidity measurements if and only if the solvent and precipitant have the same refractive index. The practical utility of turbidimetry in high polymer solutions is shown to be greatly increased by the proper use of solvent-precipitant mixtures. If the solvent and precipitant have different refractive indices, scattering measurements give information about the extent of selective absorption of solvent by the polymer.

Synthetic rubber

STRUCTURE OF ALKYLPHENOL RESIN TACKIFIERS FOR GR-S. G. E. P. Smith, Jr., J. C. Ambelang and G. W. Gottschalk. Ind, Eng. Chem. *38*, 1166–70 (Nov. 1946). Tack or "autohesion" is one of the characteristic and useful properties of uncured natural rubber. Articles such as tires can be readily built up from it because the rubber surfacee adhere when pressed together. The absence of tack in GR-S synthetic rubber was one of the most serious processing problems in the industry during the war years as natural rubber became increasingly scarce. Research both here and in Germany developed types of phenolic resins which impart to GR-S a high degree of tack sufficient for tire building purposes. These resins are prepared from certain *p*-alkylphenols and either sulfur dichloride, aldehydes or acetylene. Molecular models indicate that they are composed of crumpled, rigid chains of *p*-alkylphenol residues and that the hydroxyl groups are oriented on one side of the molecule. The hypothesis is advanced that, if the tack in milled and partly oxidized natural rubber can be attributed to association between hydroxyl groups attached to the hydrocarbon chains, the tack imparted to GR-S may be attributed to association between hydroxyl groups of the added resin.

DETERMINATION OF POLYSTYRENE IN GR-S RUBBER. I. M. Kolthoff, T. S. Lee and C. W. Carr. J. Polymer Sci. *1*, 429–33 (Oct. 1946). A convenient procedure for the determination of polystyrene in GR-S is given. The method depends upon degradation of the GR-S by tert-butyl hydroperoxide in the presence of a trace of osmium tetroxide. Polystyrene is not attacked and is separated by precipitation with ethanol.

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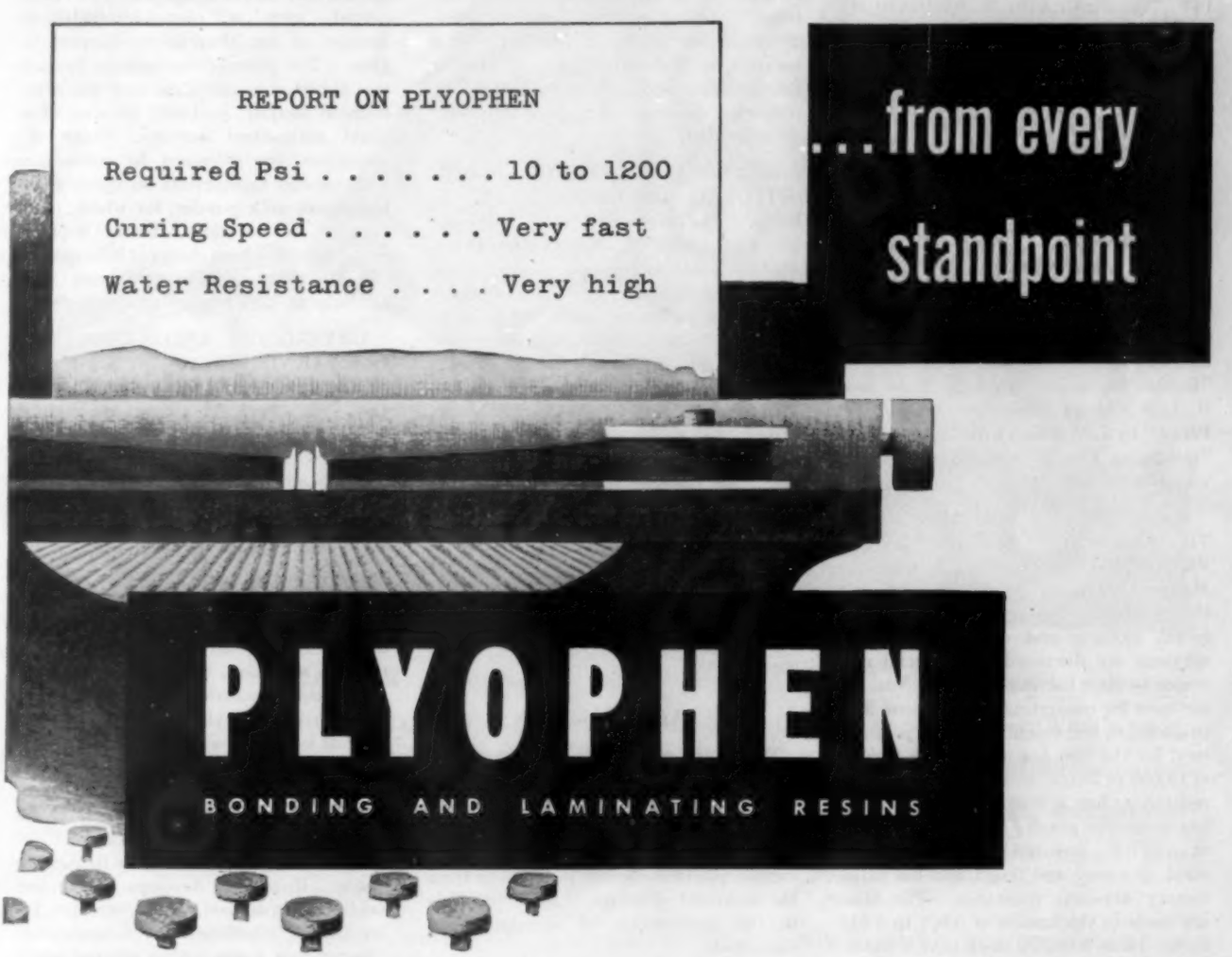

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SYNTHETIC RESINS • CHEMICAL COLORS • PHENOLIC PLASTICS • INDUSTRIAL CHEMICALS

Plastics Digest

This digest includes each month the more important articles of interest to those who make or use plastics. Mail request for periodicals directly to publishers.

General

CONTRIBUTIONS OF THE CHEMIST TO INSULATION RESEARCH. Jan. 1945 to Jan. 1946, 119 pp. Prepared by the Committee on Electrical Insulation, National Research Council. (Copies may be obtained from John D. Piper, chairman, The Detroit Edison Co. 2000 Second Ave., Detroit 26, Mich.) This is a review of the contributions published during 1945 on insulation research. The topics are as follows: "Electrical Properties of Matter," by O. M. Arnold and F. P. Cowan with 589 references. "Ceramic Insulation," by H. Thurnauer and J. W. Deaderick with 63 references. "Synthetic Plastic Insulation," by P. C. Woodland and R. F. Boyer with 130 references. "Rubber Insulation," by J. T. Blake and R. Lyle with 18 references. "Insulating Paper," by J. M. Finch with 25 references. "Insulating Oils," by C. E. Trautman with 12 references

POLYETHYLENE—A NEW PLASTIC AND A NEW MATERIAL FOR PACKAGING. J. W. Shackleton. Modern Packaging *20*, 130–4, 166, 168 (Sept. 1946). The properties, available forms, molding and extrusion of polyethylene are discussed with special reference to their use in packaging. Various methods for converting polyethylene film to packages are described. The polymer used for the film has a molecular weight of 18,000 to 20,000, has excellent chemical resistance, has a low water absorption, has a specific gravity of 0.92, is flexible at −70° F., does not need to be plasticized, is strong and tough and has satisfactory abrasion resistance. The films are made in thicknesses of 0.001 to 0.010 inch. Films 0.001 in. thick have a water-vapor transmission rate of 0.7 to 1.1 g./100 sq. in./24 hr., depending on the method of producing the film.

PLASTIC DIPS FOR PAPER PACKAGES. T. A. Howells. Modern Packaging *20*, 144–5 (Oct. 1946). Test methods and requirements for a satisfactory dip-coating for paper packages are described. No materials have been found to meet the requirements.

Materials

POLYTETRAFLUOROETHYLENE. W. E. Hanford and R. M. Joyce. J. Am. Chem. Soc. *68*, 2082–5 (Oct. 1946). An improved method for the polymerization of tetrafluoroethylene is described. The properties of polytetrafluoroethylene include abnormally high melt viscosity, insolubility in all organic solvents, extreme chemical inertness, and very low dielectric loss factor. Evidence that the polymer is a linear, highly crystalline fluorocarbon, and an explanation of its properties in terms of such a structure, are presented.

MELTING POINTS OF N-SUBSTITUTED POLYAMIDES. B. S. Biggs, C. J. Frosch and R. H. Erickson. Ind. Eng. Chem. *38*, 1016–19 (Oct. 1946). Melting point curves are presented for several families of polyamides in which the amide hydrogen atoms are progressively replaced with alkyl substituents. Lowered melting point, increased solubility and greater flexibility are correlated with increased substitution and it is suggested that these effects are due to a large extent to elimination of the hydrogen bonds between the chains which are involved.

Molding and fabricating

PLATING OF PLASTICS. British Plastics *18*, 428–32 (Oct. 1946). The methods of coating plastics with metals are reviewed.

Applications

PLASTICS FOR INDUSTRIAL PLANT CONTACTING CHEMICALS. C. H. Butcher. Plastics (London) *10*, 298–302, 341–8 (June, July 1946). The effect of chemicals and organic solvents on various plastic materials is discussed from the viewpoint of the use of these materials in the construction of chemical plant equipment.

Coatings

PLATING-RACK COATINGS. L. A. Critchfield. Monthly Rev. Am. Electroplaters Soc. *33*, 152–7, 191 (1946). The uses of synthetic resins, plastic tapes, waxes and rubbers for coating electroplating racks are described.

EFFECT OF TINPLATE AND OF LACQUERED SURFACES ON THE OXIDATIVE DETERIORATION OF BUTTERFAT. C. H. Lea. J. Soc. Chem. Ind. *65*, 136–8 (May 1946). Little difference was observed in the storage life of butterfat when packed in sealed tinplate and in lacquered containers. Dispersed as very thin films of the order of 0.02 to 0.06 mm. in thickness, butterfat was considerably less stable on a tinplate surface than on blackplate which had been coated with a phenol-formaldehyde lacquer or an oleoresinous lacquer or glass. The phenol-formaldehyde lacquer was superior to the glass and the oleoresinous lacquer, probably because of a slight antioxidant activity. These observations are discussed in connection with parallel experiments on spray dried full cream milk powder, for which, on a number of occasions, better keeping properties have been observed in lacquered than in plain tinplate containers, particularly at high storage temperatures.

DRYING OIL AND OLEORESINOUS VARNISH FILMS INCREASE IN ACIDITY ON AGING. V. J. Frilette. Ind. Eng. Chem. *38*, 493–6 (May 1946). A method is described for accurately determining the acid number of an oil or oleoresinous varnish film. The method is similar to an ordinary acid titration, but is on a semimicro scale. The acidity of oils and oleoresinous varnish films was studied by this method. In all cases a large increase in acidity occurred with aging. Preliminary evidence suggests that this acidity arises through oxidation, with the intermediate formation of peroxides, and not by hydrolysis during drying. Alkali resistance of films is determined mainly by the acid values for the films. Resins appear to act as diluents; the acidity is due in large part to oxidation of the fatty oil structure. Phenolic resins appear to inhibit acidity formation more than other resins. Tung oil develops much less acidity than linseed, which accounts for its use in alkali-resistant formulations. Oleoresinous varnish films showed much smaller increases than the corresponding oil film. The original acidity of a vehicle is negligible compared to the acidity developed on air drying. Wrinkling and disintegration are both evidences of swelling and are equivalent in evaluating alkali resistance. Oleoresinous coatings dried by baking do not develop acidity on drying; this substantiates prior contentions that the chemical reactions involved in baking and air drying differ. It was also found that while the acid number increased, the alkali resistance decreased. For several oleoresinous varnish films the alkali resistance of the films could be directly correlated with the acid number of the films; the age of the films was thus eliminated as a factor.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 25 cents each.

POLYETHYLENE. W. L. Alderson, Jr. (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,933, Aug. 20. A composition comprising normally solid polyethylene, a naturally occurring fatty acid glyceride and an ester of a carboxylic acid containing at least 8 carbon atoms.

OLEFIN POLYMERS. W. E. Hanford (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,950, Aug. 20. In the polymerization of gaseous monoolefins at elevated temperatures a pressure of from 150 to 3000 atmospheres is applied in the presence of a catalyst comprising hydrazine or a hydrazinium compound.

CELLULOSE ESTERS. T. J. Hillery (to George Benda, Inc.). U. S. 2,405,953, Aug. 20. Molding material having metallic luster is prepared by grinding and crushing cellulose acetate to a flour-like consistency, adding lard as a binder, crushing a metallic element into the same consistency and intimately mixing the two materials.

POLYETHYLENE. A. T. Larson and N. W. Krase (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,962, Aug. 20. High tensile strength ethylene polymers are prepared by passing ethylene into a tubular pressure-resistant vessel at a pressure of 500 to 1500 atmospheres and a temperature of 150 to 250° C. in the absence of a dispersing medium and in the presence of water and benzene or chlorobenzene and traces of oxygen.

POLYAMIDES. R. M. Leekley (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,965, Aug. 20. An aqueous emulsion of synthetic linear carbonamide is prepared by dissolving in a water-insoluble solvent containing a high boiling alcohol and mixing the solution with water and a surface active agent such as sodium or ammonium caseinate, triethanolammonium oleate, sodium oleate, sulfonated castor oil, oleyl sodium sulfate, polyvinyl alcohol or mixtures thereof.

HALOGENATED POLYETHYLENE. A. McAlevy (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,971, Aug. 20. An ethylene polymer is chlorinated by reacting in solution in carbon tetrachloride with sulfuryl chloride in the presence of benzoyl peroxide at a temperature between 50 and 130° C.

STARCH ESTERS. P. L. Nichols, Jr., and R. M. Hamilton (to U. S.). U. S. 2,405,973, Aug. 20. Esters are prepared from formic acid swelled starch by etherifying in a substantially anhydrous mixture of caustic alkali and an etherifying agent.

FILM MANUFACTURE. F. T. Peters (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,977, Aug. 20. Transparent films are prepared from an ethylene polymer which melts at 100 to 120° C. by casting, on a casting support heated to a temperature or less than 15° below the melting point of the polymer, a liquid composition comprising a fatty acid modifying agent and a solution of the polymer, maintaining the film on the support until the solvent has substantially evaporated and quenching the film with a non-solvent cooling liquid just prior to crystallization and haze-formation.

ADHESIVE. W. H. Sharkey, H. M. Cadot and W. B. Clark (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,405,983, Aug. 20. Plywood is adhesively bonded by an adhesive composition comprising a carboxylic acid catalyst and a condensate of formaldehyde and a hydrolyzed ethylene-vinyl acetate interpolymer.

TAPE. J. Alfthan (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,406,127, Aug. 20. Tape is prepared from polytetrafluoroethylene by pressing the material in finely divided powder form into a preform, baking the preform at a temperature above 327 and below 500° C. until it is sintered, cooling, heating to above 327° and quenching.

TETRAFLUOROETHYLENE. E. E. Lewis (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,406,153, Aug. 20. Tetrafluoroethylene polymer is depolymerized by heating above its decomposition point under a reduced pressure.

ELECTRICAL CABLE INSULATION. H. J. Cameron (to Edgar F. Seifert). U. S. 2,406,191, Aug. 20. Polystyrene is masticated between two adjacent parallel heated mixing rolls rotating in opposite directions at different speeds, adding to the plastic polystyrene mass a polymer of isobutylene.

UREA-FORMALDEHYDE. M. T. Harvey and S. Caplan (to Harvel Research Corp.), U. S. 2,406,217-8, Aug. 20. A stable aqueous solution of urea-formaldehyde condensate is prepared by heat reacting 1 to 3 mols of formaldehyde with a mixture containing 1 mol of urea and a mono-*t*-alkyl urea which possesses from four to six carbon atoms in the alkyl group.

BOTTLE CAP. E. G. King (to Armstrong Cork Co.). U. S. 2,406,227, Aug. 20. A sealing element for a container closure containing a cured alkyd resin comprising the cured reaction product of saturated and unsaturated aliphatic dibasic acid and, in addition, dipropylene glycol.

POLYSULFIDE POLYMER. L. L. Ryden (to Dow Chemical Co.). U. S. 2,406,260, Aug. 20. Cold-flow resistant polysulfide polymers are prepared by condensing an alkaline polysulfide with a mixture of a halohydrin and a polyhaloaliphatic compound to form an elastomer, and thereafter compounding with an allenedioic acid or anhydride.

RESIN. D. E. Badertscher, H. G. Berger and R. B. Bishop (to Socony-Vacuum Oil Co., Inc.) U. S. 2,406,339, Aug. 27. In the production of resinous condensates of phenols or cyclohexanol with formaldehyde a reduced reaction time and a lighter color are obtained by the use of hydrogen fluoride.

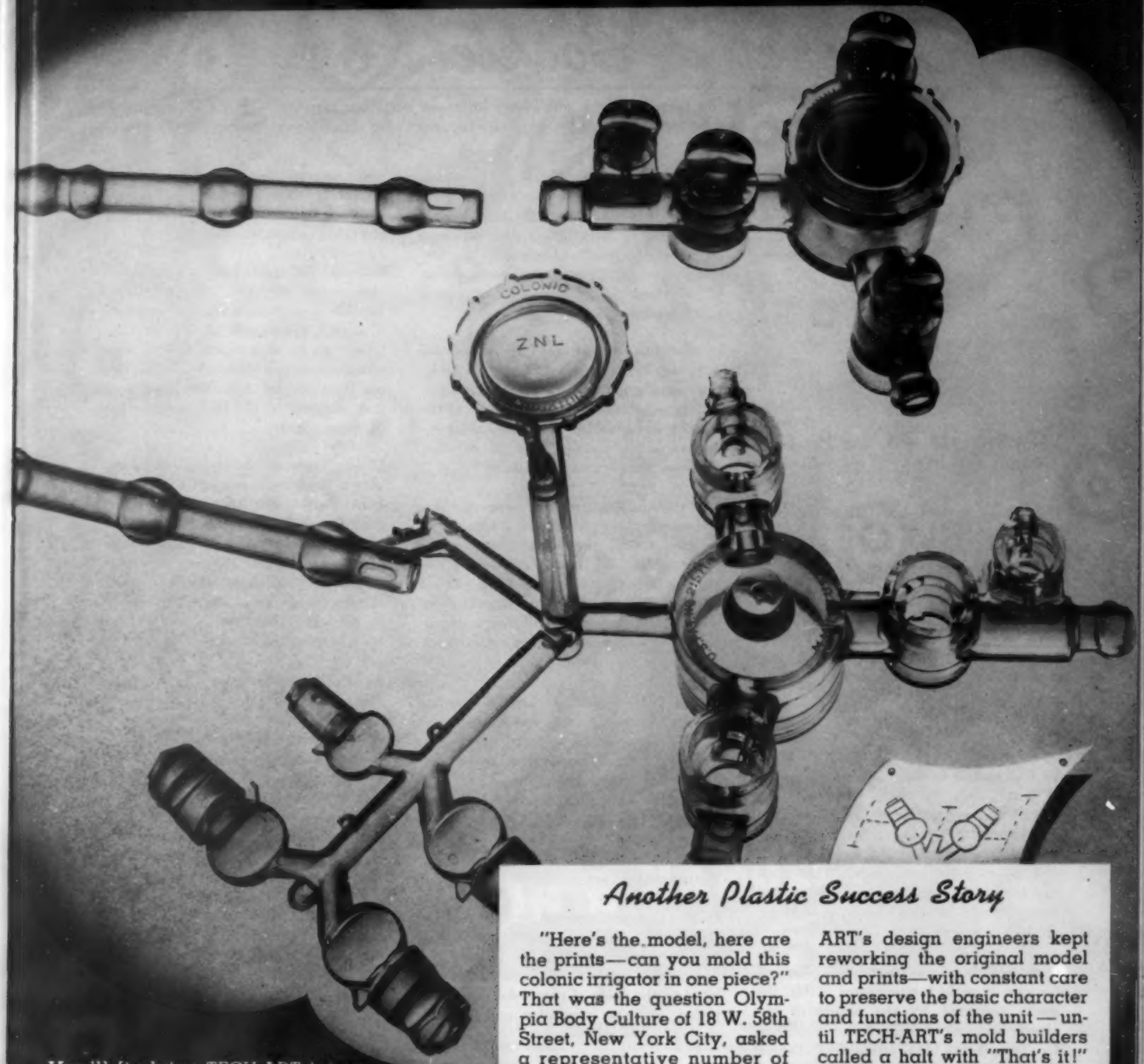
CARBOHYDRATE ETHERS. R. M. Hamilton and P. L. Nichols, Jr. (to U. S.). U. S. 2,406,369, Aug. 27. Organic solvent-soluble allyl ethers of starch and cellulose.

ABRASIVE. S. S. Kistler (to Norton Co.). U. S. 2,406,385, Aug. 27. An abrasive article is prepared by treating unvulcanized butadiene polymer with a halogen-containing plasticizing agent, adding a vulcanizing agent, abrasive grains, and a resin having amino groups capable of reacting with the plasticizing agent at elevated temperatures, shaping the mix, and finally heat treating to cause reaction between the halogenated plasticizer and the amino resin and vulcanization of the butadiene polymer.

OPTICAL ELEMENTS. J. H. Richardson (to Polaroid Corp.). U. S. 2,406,401, Aug. 27. A mold for a prism of polymerized synthetic resin.

POLYMERIZATION. H. G. Rogers (to Polaroid Corp.) U. S. 2,406,403, Aug. 27. A deformable polymerization chamber and means for alternately compressing different portions thereof in order to induce a reciprocating circulation the mass itself.

The "IMPOSSIBLE" . . . Molded in Plastics



Another Plastic Success Story

"Here's the model, here are the prints—can you mold this colonic irrigator in one piece?" That was the question Olympia Body Culture of 18 W. 58th Street, New York City, asked a representative number of molders.

"Impossible!" said many.

"Impractical," said the rest.

And then the query was put to TECH-ART.

"Don't know," was the answer. "*Think* we can. We'd certainly like to try!"

"Fair enough," was Olympia's response. "Go to it!"

And go to it they did. TECH-ART's design engineers kept reworking the original model and prints—with constant care to preserve the basic character and functions of the unit—until TECH-ART's mold builders called a halt with "That's it!" The mold was completed, test runs were made, mold adjustments and refinements accomplished, and production procedures set up. Then a final check and production approval by Olympia. And then—mass production of the complicated unit shown above . . . the "impossible" molded in plastics . . . and another plastic success story by TECH-ART.

You'll find that TECH-ART brings *all* its resources to bear on your plastics product problem—be it a bead or a bandbox—before passing final judgment . . . resources that include comprehensive product engineering—complete mold-building facilities—modern equipment and production methods—knowledge of the nature and applications of plastic materials. It's a procedure that's kept many a plastics product out of the "can't-be-done" file—and it may be able to help you. Why not talk *your* problem over with TECH-ART?

TECHNICAL NOTES: The material selected was clear polystyrene—for durability, moisture resistance, and clean-cut appearance. Sixteen removable mold plugs were employed to produce the required openings in the unit.

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SUCCESSORS TO BOONTON RUBBER MANUFACTURING COMPANY
PIONEER PLASTIC MOLDERS . . . Established 1891

TECH-ART PLASTICS COMPANY

Books and Booklets

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery.

Chemical Engineering Catalog

Published by Reinhold Publishing Corp., 330 W. 42nd St., New York City, 1946.

1768 pages

This catalog, distributed free of charge to members of the industry, provides a collected source of condensed and standardized data about equipment, machinery, raw materials and laboratory supplies used in industries employing chemical processes of manufacture.

Plastics Handbook for Product Engineers

by John Sasso

Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York City

Price $6.00 **468 pages**

This handbook is a collection of engineering data on plastics and synthetic rubber and includes chapters on their chemistry, prepared by Paul O. Powers. Much of the balance of the material is a condensation from material that originally appeared in Product Engineering. Such subjects as Fundamental Design Considerations, originally written by W. S. Larson, articles on specific synthetic rubbers by the various rubber companies, as well as several general articles on finishing, processing and recent developments are coupled with specific properties tables which were furnished by the P.M.M.A. and its member companies. This book concentrates primarily on information which would be specifically needed by product engineers.

Mold temperature control—The maintenance of mold temperatures within the limits indicated by the nature of the plastic being molded can be accomplished by Tempilstiks, the product of Tempil Corp., 132 W. 22nd St., New York City. A bulletin explaining this method of temperature control has recently been issued by the company.

Pearl essence — Technical Specialties Co., 184 Commercial St., Malden, Mass., has prepared a price listing and handbook on synthetic pearl essence and lacquer dispersions.

A glossary of chemical terms—Now available upon request to the B. F. Goodrich Chemical Co., Rose Bldg., Cleveland 15, Ohio, is a 12-page Glossary of chemical names, terms and phrases used in the plastic and rubber industries.

Also received from the B. F. Goodrich Chemical Co., are the two latest service bulletins on Geon latex compounding. The effects of thickening agents on Geon latex and the results obtained by the use of a number of plasticizers commonly used in polyvinyl chloride resin compounding are presented.

Production tapping—The Cleveland Tapping Machine Co., Hartville, Ohio, has recently published a guide to production tapping. Cognizance is taken of the plastics industry by the inclusion of information on the tapping of acrylics, cellulose nitrate and phenolic.

The uses of furfural—A comprehensive picture of the importance of furfural to all industry is presented in the latest Bulletin, No. 204, being published by The Quaker Oats Co., Chemical Dept., Board of Trade Bldg., Chicago, Ill. Uses of furfural as a selective solvent, a dispersant, resin-former and chemical intermediate are fully covered.

Chain and trolley hoists—Chester Hoist Co., Lisbon, Ohio, has just issued a new 16-page bulletin covering their complete line of spur geared (high speed) and differential chain hoists, together with their Army-type low headroom Timken equipped trolley hoists. Tables, section and photographic views of the various products, including a complete line of I-Beam trolleys, are included.

Industrial equipment — The Annual Review for 1945 has recently been issued by Allis-Chalmers Mfg. Co., Box 512, Milwaukee 1, Wis. A-C machines related to the fields of processing, transportation, and the generation and distribution of power are covered.

A report to the people—Stone & Webster Engineering Corp., 90 Broad St., New York City, has published a book covering the part played by this corporation from before Pearl Harbor to Hiroshima. This book, which has been sent out to a limited distribution list, presents in a brief pictorial form the corporation's vital role in the synthetic rubber and process industries and in the production of the atom bomb.

A new cellulose derivative—Hercules Powder Co., Wilmington, Del., has announced the commercial manufacture of CMC, the sodium salt of carboxymethylcellulose. CMC's possible uses and its properties of both water-solubility and insolubility, low flammability and ready compatibility are discussed in a recently published pamphlet.

Silicone diffusion pump fluids—Diffusion pump oils, DC 702 and DC 703, capable of producing vacua ranging up to 5×10^{-9}, yet capable of withstanding exposure to air and moisture at operating temperatures without any appreciable decomposition, are described in a booklet just released by the Dow Corning Corp., Midland, Mich.

Plastic veneer—A recent advance in plastic finishing is marked by a full-color booklet being distributed by The Meyercord Co., 5323 W. Lake St., Chicago 44, Ill. The wide industrial uses, flexibility and application of the firm's wood and marble recreations in plastic veneer are illustrated, showing that the product can be used as all-over finish, as banding, or trim, or in combination with inlay.

Synthetic rubber—Various types of synthetic rubber are identified and described in detail, and an impartial analysis of their properties is shown in tabular form in a booklet recently issued by the United States Rubber Co., Rockefeller Center, New York City. Also included are a technical appendix, which gives the chemical structure of rubber and the synthetic rubbers, and a useful glossary of terms used in the industry.

Phenopreg MB materials—The Plastics Div. of Fabricon Products, Inc., 1721 Pleasant Ave., River Rouge 18, Mich., has distributed a bulletin on melamine resin impregnated Phenopreg MB grades. Standard MB stock grades and printed patterned materials are described in complete detail.

Nylon—The Nylon Div. of E. I. du Pont de Nemours & Co., Inc., Wilmington 98, Del., has brought out a brochure on nylon. The manufacture and invention of the material are explained, and a section is devoted to such properties of nylon as its strength, resistance to abrasion, to moths and to mildew.

Protective coatings — A new technical booklet on protective coatings has been released by the Watson-Standard Co., Pittsburgh, Pa. The physical properties, suggested usages and all pertinent information on various Vyn-Cote and Plastisol coatings are included.

WHAT'S IN A HANDLE?

EXAMINE this Norton-molded plastic handle closely.

Looks as though it were simple to produce, doesn't it?

Actually a job of this sort calls for great skill on the part of the custom molder. First, he must satisfy strict design requirements which, although primarily functional in nature, call for a handle that blends perfectly with the lines of the finished product. Secondly, the molded handle must meet stringent mechanical requirements such as heat resistance, impact strength and pleasant "feel."

For years, Norton's experienced design engineers have been working closely with progressive, plastic-minded manufacturers representing practically all fields of industry... from cosmetics to household appliances.

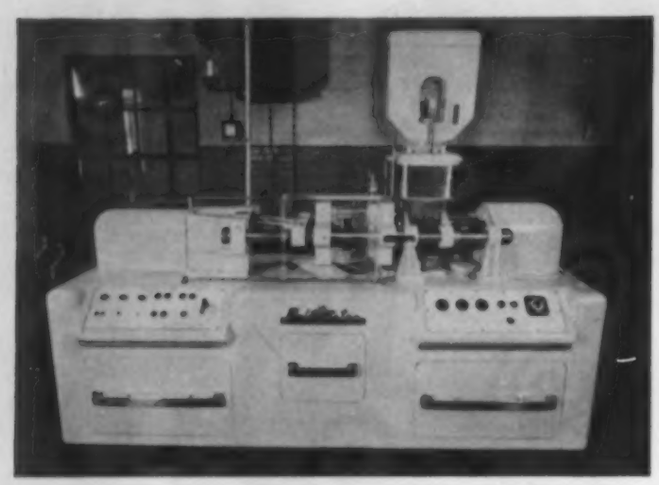
Combine this rich background of successful product development experience with the extensive facilities for compression and injection molding which are available here and you can easily understand why leading producers everywhere all look to Norton for their custom molding.

Why not send us a detailed description of your plastics problem? Norton Laboratories, Inc., Lockport, N. Y. *Sales Offices: 347 Fifth Avenue, New York City... 9 South Clinton St., Chicago.*

NORTON *Laboratories, Inc.*

COMPRESSION AND INJECTION MOLDING

New Machinery and Equipment



Injection molding machine—Crown Machine & Tool Co., 2800 W. Lancaster Blvd., Fort Worth 7, Texas, has introduced the Crown Moldmaster, new type low-cost machine that molds at low pressure range of from 3000 to 8000 p.s.i. This machine can turn out molded articles at a rate of 180 pieces per hour. The low operating pressure has made possible construction of a lighter, more compact machine. The machine operates on a 15 hp. motor which is unloaded to 7½ hp. during the greater part of each molding cycle. Facts and specifications are: unit molds all thermoplastic materials; granular plastic feed through gravity-feed hopper with agitator, operates automatically on cycles as short as 20 sec. (3 shots per min.); uses multiple or single cavity molds; platen size, 12 by 12 in.; mold thickness can vary from 4½ to 10 in.; injects 7½ cu. in. of plastic or 4 oz. per shot; hydraulically powered, electronically controlled; selective operation, manual, semi-automatic or fully automatic; safety shield to protect operator; temperature controlled with electronic pyrometer; weight about 550 pounds. First production model is now being produced for the die casting of non-ferrous metals.

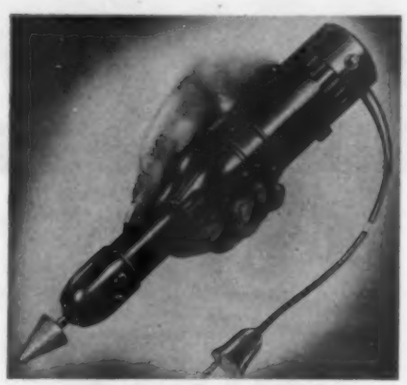
A hydraulic power unit—Lyon-Raymond Corp., 2935 Madison St., Greene, N. Y., offers a hydraulic power unit for stacking or tiering, where speed of elevation is important. Designed for the company's hydraulic high-lift trucks, the unit is compact and self-contained, consisting of electric motor, hydraulic gear-type pump, valves, oil reservoir and necessary controls. It is available with either a ½ hp. or ¾ hp. motor. The danger of overloading is eliminated by a factory-adjusted relief valve contained in the hydraulic system.

Heavy-duty mill—The Buffalo Hammer Mill Corp., 27 Washington St., Buffalo 3, N. Y., has added a new heavy-duty model W-30 Hammer Mill to its line of 16 standard types. This model has an overall height of 47 in., base 53 by 38 in., charge opening 24 by 30 in. and can be used for grinding, pulverizing, crushing, shredding, defiberizing and hashing various materials. Material is broken by shattering blows of several batteries of revolving hardened steel hammers at 1000 to 75,000 r.p.m. and is hit while suspended in mid-air to eliminate the generating of heat from the friction of rubbing and crushing actions. A built-in trap which extracts foreign substances after they enter the mills protects the new model. Material may be discharged by gravity or conveying pneumatically to collection system.

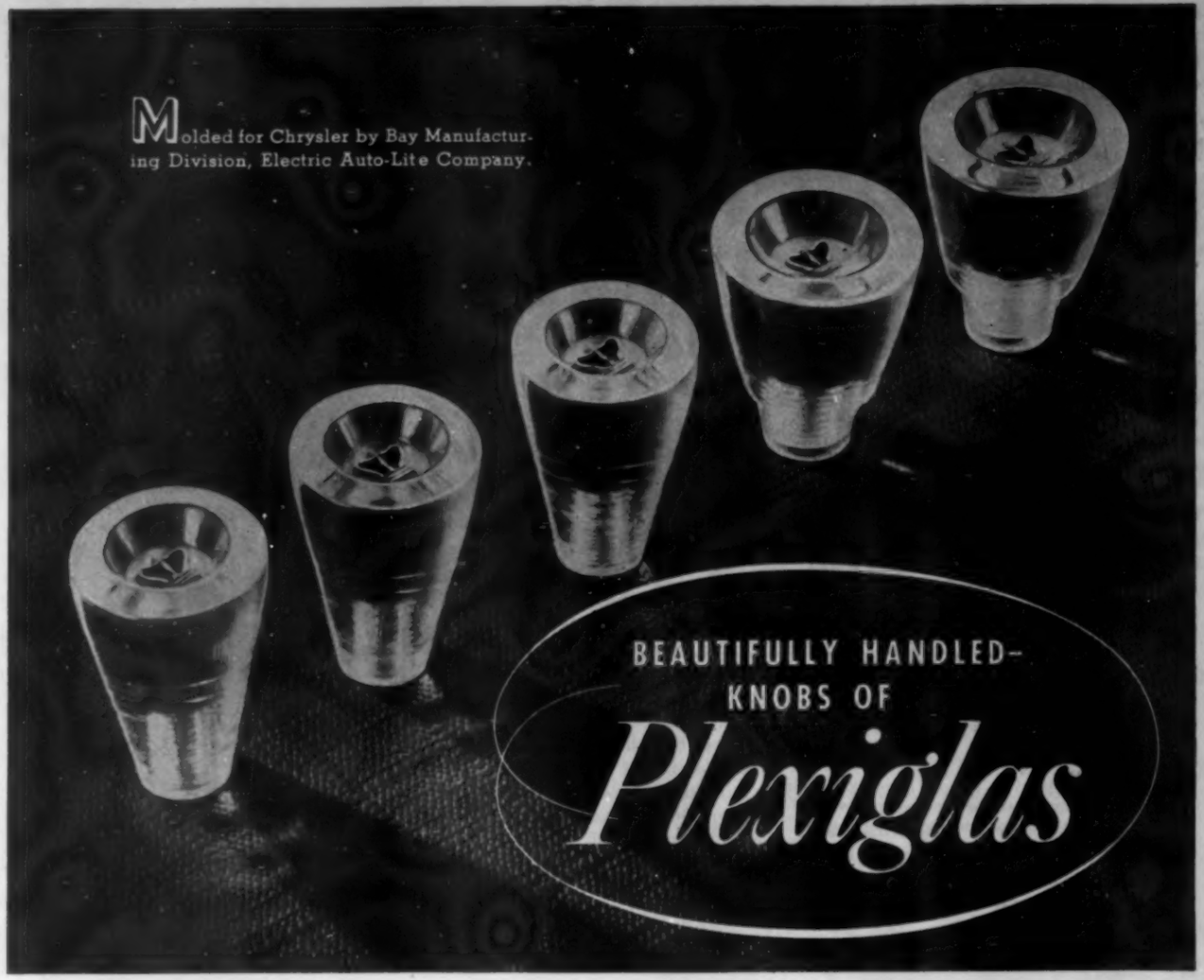
A mixer and densifier—A new automatic mixer and densifier for use in the manufacture of plastics is being manufactured by the Beardsley & Piper Co., 4710 W. Division St., Chicago 51, Ill. This machine mixes and reduces the volume of the material in one simple operation, producing finished molding powder ready for grinding. Rolling or milling is eliminated. It will mix, densify and saturate various types of fillers with dry or liquid resins. Fillers such as asbestos, mica or glass fiber, which do not absorb resins, are coated uniformly. Certain rubber compounds may also be processed. Equipped with time and temperature controls, the densifier regulates and will duplicate the heat and length of cycle, eliminating variations between batches. The machine produces dispersion of from 1000 to 6000 lb. an hour depending on the material. Batches up to 300 lb. may be processed in from 2 to 4 minutes.

Conveyor—A conveyor for carrying material from extruders has been marketed by the Island Equipment Corp., 101 Park Ave., New York 17, N. Y. It has three control wheels, one for adjusting the height of the 2 in. long in-feed section and two providing convenient operating positions for the travel speed of the belt. This equipment can be supplied with variable speed units from 300 r.p.m. maximum to 0 r.p.m. minimum.

A high speed electric hand tool—For grinding, milling, drilling, finishing and polishing of plastics, metals, glass and special operations such as milling hardened steel and stainless steel welds with carbide cutters, Precise Products Co., 1328–30



Clark St., Racine, Wis., has announced the PRECISE–40. This hand tool has ⅛ hp. and speeds to 40,000 r.p.m. It is cased in plastic and weighs 40 ounces. Features include a larger, more rigid precision quill fitted with a #0 Morse taper for interchangeable mounting of precision collet chucks for rotary cutters and millers, a Jacob's chuck for small or special arbors for unmounted grinding wheels diameter drills, abrasives of various kinds and



Does it pay to be particular about the little things? Take, for example, the automotive designer who gives so much study to the proper material for a small item like the handle of a gearshift lever—and chooses PLEXIGLAS.

Important? Yes, because PLEXIGLAS has a crystal-clear beauty that will retain its sparkle throughout the years—without clouding or discoloration. Important, too, because PLEXIGLAS is light in weight, friendly to touch, ruggedly durable, shatter resistant, easily molded and fabricated to a variety of unusual designs.

This handle is but one of many PLEXIGLAS handles and knobs on today's cars—one of many ways in which the automotive industry has taken advantage of this fascinating plastic. Today, designers use it for radiator ornaments, instrument dials and lenses, interior trim, horn buttons, tail-lights, name plates and scores of other fittings. Tomorrow, new uses will be found for this sparkling, versatile material.

For any technical assistance or information, write or call our nearest office; Philadelphia, Detroit, Los Angeles, Chicago, New York. Canadian Distributor: Hobbs Glass, Ltd., London, Ontario.

PLEXENE M—*a promising new modified styrene co-polymer molding powder . . . weather resistant . . . heat resistant . . . gasoline resistant . . . available at recently reduced prices. Ask for details.*

Only Rohm & Haas Makes
Plexiglas
Acrylic Plastic Sheets and Molding Powders

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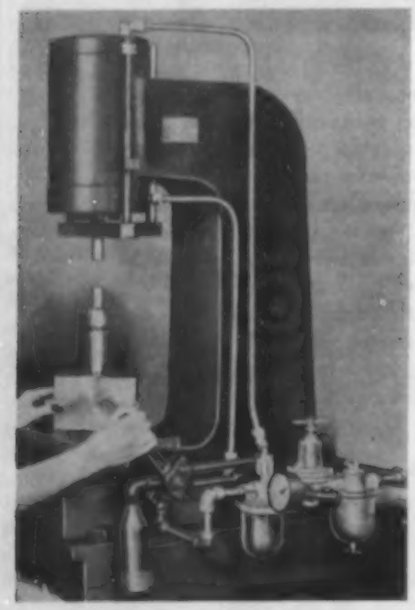
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

Manufacturers of Chemicals including Plastics • Synthetic Insecticides • Fungicides • Enzymes • Detergents
Germicides • Chemicals for the Leather, Textile, Ceramic, Rubber, Paper, Petroleum and other Industries

special spindles mounted so as to extend the quill length for internal grinding and engraving. An aerodynamic fan mounted on motor shaft cools the tool and blows away dust and chips. The tool can be used alone or mounted in stand, vise, lathe or milling machine.

Mechanical pressure gage—For checking pressure between spot welding machine electrodes, pressure between platens in all types of presses, pressure between moving rollers, tension in a moving thread, twine, wire, etc., W. C. Dillon & Co., Inc., 5410 West Harrison St., Chicago 44, Ill., has introduced a compact mechanical pressure gage. The unit is designed to slip into small spaces and give data quickly. A jeweled dial indicator is mounted on a "V" shaped pressure bar in such a way that when the load is applied to the bar on anvils at its center, the indicator measures the amount of deformation, translating it directly into pounds pressure. Several models are available: the 0–100 lb. model, the 0–250, 0–500, 0–1000, 0–2500 and 0–5000 lb. models. According to the company, it works in vises, between all types of clamps and can be converted into a miniature testing machine. It is almost entirely unaffected by even the more extreme temperature changes.

Two air powered arbor presses—Two new air powered all-steel welded construction arbor presses, the Hurricane Six and Eight, are announced by the Studebaker Machine Co., 1221 S. Ninth Ave.,



Maywood, Ill. They are suited for light push or pull broaching jobs as well as for fast assembling, stamping, forming, riveting, punching, cutting and other punch press operations. Double acting air cylinders are used on both models. The Six develops 1 ton ram pressure on the down stroke at 80 lb. air line pressure and 1 ton on the up stroke. At 120 lb. air line pressure it develops 1½ tons ramp pressure on both strokes. The Eight develops two tons ram pressure on the down and up strokes at 80 lb. air line pressure and 3 tons at 120 lb. air line pressure. Both can give up to 200 sharp punch press ram blows per min. or be regulated to a very slow squeezing action if desired. The ram pressure can be preset from a few pounds to maximum and the stroke can be regulated from a few thousandths to six inches.

High pressure hydraulic power units—B. F. Perkins & Son, Inc., Holyoke, Mass., has added a series of high pressure hydraulic power units to the present line of accumulators and hydraulic valves. It includes power units from 0.75 to 34 g.p.m. using three types of pumps—1000, 3000 and 10,000 p.s.i. maximum pressures. Each unit is furnished with pump, motor, reservoir, filter, oil level gage and adjustable pressure control valve.

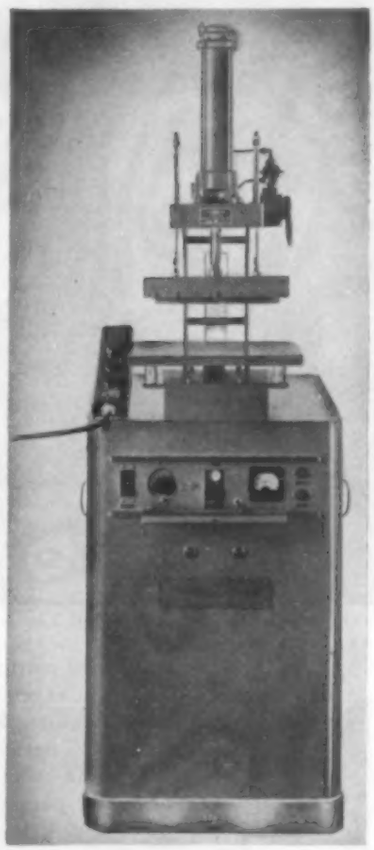
Heavy-duty tool and cutter grinder—For the heavier work of gumming and gashing cutters and for use in grinding cutters tipped with tungsten-carbide, the Oliver Instrument Co. of Adrian, Mich., has introduced a heavy duty Ace tool and cutter grinder. Exclusive features include a fixed diamond which compensates for wheel wear, a means for grinding eccentric relief on milling cutters and reamers and means for direct reading.

Parts lettering and numbering machine, improved foot press name plate stamping machine—Model IF, an improved foot press name plate stamping machine, and Acromarker No. 1AR for stamp lettering and numbering on a variety of parts and name plates have been developed by the Acromark Co., 365 Morrell St., Elizabeth 4, N. J.

No. 1AR is about the size of a No. 3 arbor press, and the frame and ram are of similar construction. The gear and rack ram is adjusted by turning the handwheel on the right side of the machine and locking. It permits marking parts ranging from paper thickness to 9 in., and the open area of the frame allows these parts to be marked as much as 8 in. from the outside edge. Special bases handle larger sizes. To stamp in a curved line, a rotary fixture is placed on the marking table and a worm gear rotates the fixture holding the part. Interchangeable die heads from 1/16 to 3/16 in. are available. The machine can be used on plastic, unhardened tool steel, cast iron, bronze, brass or wood parts.

A new multiple lever and cam foot pressure has been incorporated in the Model IF machine and increases the foot power six to eight times. Another improvement is in the character spacing adjustment and a new simple thickness adjustment has been added. The cast iron pedestal has been enlarged for sturdiness while the tolerances of all parts entering into the assembly of this machine have been reduced 0.0015 for greater precision. Marking dies are now machine engraved and hand finished. The improved foot power arrangement leaves the hands free for feeding of the parts and indexing of the character head.

Sealer—For sealing, bonding or welding thermoplastic sheets, the Thermatron Div., Radio Receptor Co., Inc., 251 West 19th St., New York 11, N. Y., has intro-



duced a new 2½ kw. Thermatron dielectric sealer, Type K-3-S. Applying radio frequency, the unit produces air-tight, water-tight seams stronger than the thermoplastic sheets themselves. Self-concontained the unit is designed so that the Type 4 sealing press, shown above, may be mounted on the unit and operated by foot controls. Straight or shaped bar electrodes make possible a wide range of seams for sheets of various lengths and thicknesses from 0.002 to 0.040 inch. It will bond two pieces of 15 sq. in. in area of 0.004-in. vinyl or a 1/4 in. seal 60 in. long in approximately 10 seconds. Other available units are: Type K-500, 500 watt output: Type K-1, 1 kw. output; Type K-5, 5 kw. output; Type K-8, 7½ kw. output: Type K-15, 15 kw. output; Type K-30, 30 kw. output. (*Please turn to next page*)

NOMINATIONS

ARE NOW BEING ACCEPTED BY THE COMMITTEE FOR

THE JOHN WESLEY HYATT AWARD

FOR THE ADVANCEMENT OF PLASTICS

Sixth Annual Award

The John Wesley Hyatt Award, consisting of a gold medal and $1,000, is made annually to the individual who has made, in the opinion of the judges, outstanding achievement of wide importance to the plastics industry.

ENTRIES

Any person, whether he or she be a molder, tool-maker, laboratory technician, executive, or engaged in any other capacity, is eligible or may submit one or more entries. There is no fee of any kind. Anyone may enter or be entered. Statements of qualification (Entry Blanks) are being mailed to the industry. Additional entry blanks may be obtained from the Committee Secretary, 295 Madison Avenue, New York 17, N. Y. Nominations close 5 p. m., March 3, 1947.

PREVIOUS MEDALISTS

1941—Dr. Donald S. Frederick, Plastics Division, Rohm & Haas Company, Philadelphia, for adaptation of large transparent colorless sections of methyl-methacrylate to bombers and other military aircraft.

1942—Mr. Frank Shaw, President, Shaw Insulator Company, Irvington, N. J., for development of the process for transfer molding of thermosetting materials.

1943—Dr. Stuart D. Douglas, Head of Plastics Research, Carbide and Carbon Chemicals Corporation, South Charleston, W. Va., for his outstanding research work in the polymerization of vinyl compounds, the increased commercial production of which, in 1943, made possible the manufacture of war materials urgently needed by the nation for the prosecution of the war.

1944—Mr. William Iler Beach, Chief Plastics Engineer, North American Aviation, Inc., Inglewood, Calif., for his research and development on the process of post-forming phenolic laminates, which materially helped to increase production and improve performance of airplanes through the replacement of metals with plastics.

1945—Mr. Virgil E. Meharg, Superintendent of Development, Bakelite Corporation, Bound Brook, N. J., and Mr. Paul D. Zottu, Consulting Electronic Engineer, Newton, Mass., for their individual work in developing the use of electronic heating of thermosetting plastic materials. This research was conducted separately and simultaneously by the two men. Their efforts resulted in a speeding up of the curing time of molded and laminated plastics and contributed much to the winning of the war.

THE JOHN WESLEY HYATT AWARD

Secretary to the Committee

WILLIAM T. CRUSE, 295 Madison Avenue, New York 17, N. Y.

CP7-1

Live centers—Live centers are used with carbide-tipped tools which operate at higher machinery speeds to eliminate friction in the head and tailstock. Holub Industries, Inc., Sycamore, Ill., has brought out a new line of "Hi" live centers which are designed to handle heavier loads at higher speed. The live centers are equipped with matched and preloaded Timken bearings. The bearings are matched in pairs with eccentricity points lined up preventing "fighting" and preloaded by means of the threaded adjusting ring. Eccentricity or run-out of point is held to 0.0002 in., both free and under load. According to the company, the center assures high load carrying capacity up to 1000 lb. in the No. 2 and 3 Morse taper sizes and up to 2400 lb. in the No. 4 and 5 sizes. Another improvement is a heavy duty grease seal which resists wear from metal chips and prevents the entrance of foreign matter.

Hydraulic presses—A line of power-operated hydrulic presses that have neither motor nor pump has just been announced by Elmes Engineering Works of American Steel Foundries, 1002 Fulton St., Chicago 7, Ill. According to the company, this new principle promises greater economies in the molding of plastics and rubber, in assembly forcing, straightening and testing. Compressed air from shop line, introduced above the liquid by simplified control, provides the power for rapid closure and instantaneous full pressure. It applies and maintains any desired pressure within capacity range and repeats at that pressure until reset. These presses are made in 20 and 30 ton bench-type and floor-type models, and in 50 ton floor-type. The 30 ton floor-type, for example, has 6 in. stroke, opening adjustable from 0 to 13 in., may be equipped with 10 by 10 in. hot plates.

An infrared appliance—The Miskella Infra-Red Co., East 73rd and Grand Ave., Cleveland 4, Ohio, has introduced the Tray-veyor, a versatile infrared appliance. It can be used for uniform preheating of plastic pellets, for processing small lots or samples of baked enamel and for heating bearings so they may be slipped onto shafts. Insulated-reflective heat units suspended with two sets of four combination lamp-saver shock absorbers and distance away adjustments establish the heat setting. There are eight lamps with four control switches—one for each two lamps. Total load is 2000 watts while the temperature range, with or without an autotransformer, is 70 to 300° F. Specific setters may be established by calibrated dial and indicator needle.

A power press—Ketchpel Engineering Co., 1401–1405 Palisades Ave., West Englewood, N. J., has announced a power press which is said to combine high-speed production with low-cost operation in removing mandrels and metal cores from molded plastic parts, or the broaching and keyway cutting of plastic and metal parts. Two models are available—No. 13, power post with constant 21 in. stroke and No. 14, power post with variable stroke. Features include extraction with straight line pull which provides removal of mandrels without bending, vertical action confining operation to small working areas, extra long piston stroke.

Drying ovens—Trenco, Inc., of Box 1778, New Haven, Conn., has introduced two plastic drying ovens, Model No. 271 and No. 270. Model No. 271 has seven drawers, 24 by 18 by 1⁷/₈ in., and a heating capacity of 3 kw. Model No. 270 has 14 drawers, 24 by 1⁷/₈ in. and a heating capacity of 5 kw. Other specifications which apply to both models: 10 lb. per drawer; electrical characteristics, 230 v. 3 ph. 60 cys.; rock wood batten insulation; cabinet depth of 2 ft. 4¹/₂ in., height of 4 ft. 3 in. The cabinet width for No. 271 is 3 ft., that for No. 270 is 4 ft. 7 inches.

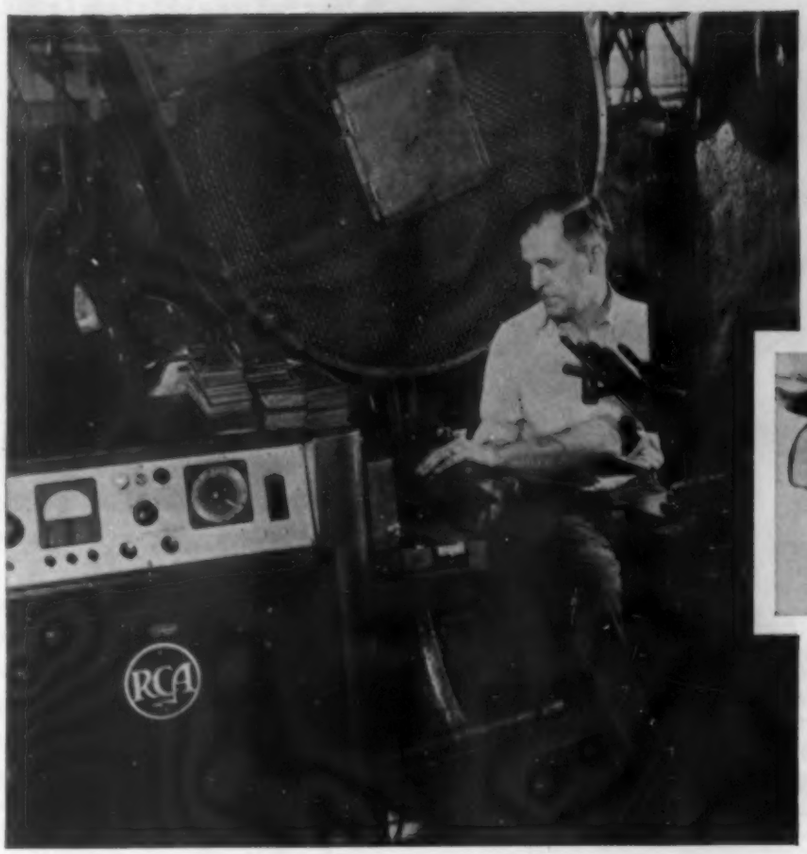
Single vinyl-coating compound

The process of coating fabrics with vinyl resins has often been complicated and prolonged by the necessity of working with two different coating solutions. In an effort to get around these difficulties, Roxalin Flexible Finishes, Inc., of Elizabeth, N. J., has developed a formulation which accomplishes the coating in one application.

This single vinyl compound containing a high solids content effects a soft, dry, durable waterproof and flameproof film. Since it is the solution itself that is flameproof, it does not necessarily render the base fabric non-flammable—although it discourages burning. Coated cottons and heavy materials will burn slowly and if it is desirable to fireproof them, they should be impregnated with a flameproof agent before applying vinyl coating. In case of rayon, nylon, celanese, etc., enough coating is absorbed to make them totally fireproof.

The vinyl solution is obtainable in liquid form and may be applied by any coating method that is preferable. However, the basic principle in all of them involves its application to moving fabric and the removal of excess by some scrapping method. Coating machines may be either horizontal or vertical; that is, in some machines the cloth travels horizontally while in others it travels vertically. In the case of the horizontal machines, the liquid is poured on the cloth just before it passes over a thin metal bar usually called a doctor blade. This blade holds back the excess and can be regulated to allow more or less coating to remain on the cloth. The variations are both in distance from the cloth and in angle of blade. In case of vertical coating machines the solution is poured into a trough. A metal cylinder is mounted in the trough, so that it can rotate and furnish solution from the trough to the cloth. Here, too, a doctor blade is used to scrape off the excess. The cloth is then passed through heating units. These may be steam coils, hot can, or even infrared lamps. After cloth is dried and before it is rolled it should be cooled by passing over metal cylinder containing circulating cold water. This prevents sticking of cloth to itself.

KELLOGG CUTS LAMINATE PUNCHING REJECTS TO 1%



UNIFORM, HIGH-SPEED, PREHEATING of laminated stock prevents chipping and cracking. Operator places a cold strip in the custom-built applicator mounted on side of the 2-kw RCA Type 2-BHF electronic power generator. The heated strip in right hand will be stamped while cold strip is being brought to exactly the right temperature.

PREHEATED STAMPINGS are used as small insulating parts in many of the company's products—here shown as used in a telephone set.

Perfect laminate stampings now made with RCA ELECTRONIC HEAT

THE Kellogg Switchboard and Supply Company, of Chicago, stamps laminated phenolic sheet stock into small insulating parts for use in many of its products.

As this material is brittle, heating is required before punching to make the resinous base sheets workable.

Before dielectric heating was used, even the best of the other heating methods tried resulted in a high percentage of rejects due to cracking and chipping during stamping.

Now—using a 2-kw, Type 2-BHF, RCA Electronic Generator to furnish high-frequency power—each laminated sheet is placed between the electrodes of a Kellogg-built applicator mounted on the side of the generator. The intense alternating electric field set up in the material causes heat to be developed *uniformly* and speedily, thereby taking full advantage of the material's residual plasticity. The heat does not have to "seep" in from the surface as with other heating methods. Temperature can be controlled to within very close limits so that each sheet is heated to exactly the same degree. Rejects have been cut to the vanishing point, output increased, and costs drastically reduced.

Whether your problem is punching plastics laminates, sealing thermoplastic materials, or heating preforms, we'll be glad to study your product or process to determine whether RCA Electronic Heat will also help *you* get *greater* production of *higher*-quality units at *lower* cost. Write: Dept. 55-A, Electronic Apparatus Sec., Radio Corporation of America, Camden, N. J.

ELECTRONIC HEATING

RADIO CORPORATION of AMERICA

ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

Items 1–1582, which have appeared previously, are correlated in the Plastics Stock Mold Catalog, available for $5.00.

Molders and fabricators are invited to submit samples of stock products to appear on these pages as space permits.

Plastics Stock Molds*

SHEET ONE HUNDRED FORTY-FIVE

Assorted utility and gift items are suitable for a variety of uses in the home. Additional information, manufacturers' names and addresses, may be obtained from the Stock Mold Div., MODERN PLASTICS, 122 E. 42nd St., New York 17, N. Y. Please state sheet and number.

1714. Transparent molded stand-up picture frame. Overall size 8 by 6 in. For photo 5 by 7 inches.

1715. Transparent collapsible drinking and measuring cup with snap cover. Graduated from 1/2 to 5 oz. Wall sections are heavy and shockproof.

1716. Doughnut and cookie cutter, 2 1/2 in. in diameter. Center part is removable, transforming it into a larger cookie and biscuit cutter.

1717. Pin-wheel type tie rack with 12 rods and metal wall bracket; 6 in. overall diameter.

1718. Opaque and clear cellulose acetate containers with snap cover; 1 1/2 in. high with 1 1/2 in. diameter throughout.

1719. Table cigarette lighter fabricated with alternating layers of colored and clear acrylics; 3 in. high with 2 3/4 in. diameter at base.

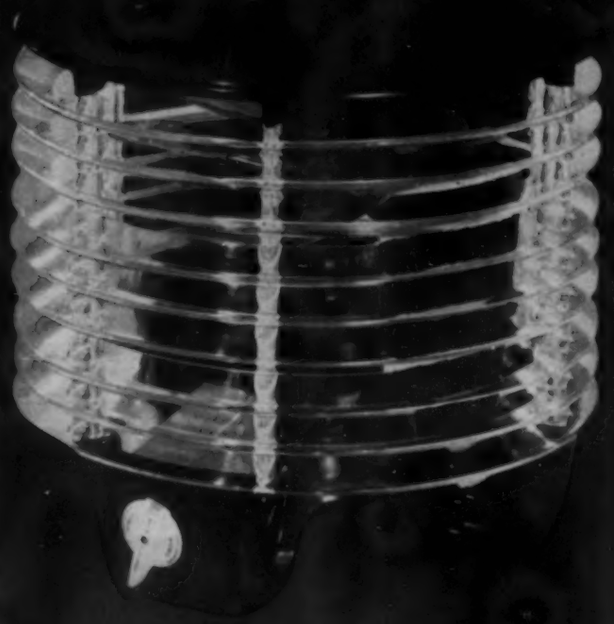
1720. Cake decorator and cookie maker set. Extra large cloth bag has plastic screw attachment, six interchangeable decorating tips, three cookie makers. Also available in single sets.

1721. Flexible expanding extruded watchband which is of ribbed cellulose acetate.

* Reg. U. S. Patent Office.

another tough production problem licked by

Lustron



What the designers and engineers wanted:	What the designers and engineers got with Lustron:
A material free of the usual dimensional limitations, capable of carrying out a design that was functionally and aerodynamically sound.	Lustron's dimensional stability and molding adaptability.
Light weight, since it was to be carried from room to room.	Lustron's light weight—17% to 25% lighter than many other thermoplastics and one-tenth the weight of alternative materials.
Adequate insulation for safe and efficient operation.	Lustron's excellent electrical properties.
Color necessary to accent striking design.	Lustron's rainbow range of colors.
Economy, manufacturing costs to be kept down to make a favorable selling price.	Lustron's low cost per pound, light weight resulting in more units per pound, and its adaptability to low cost molding processes.
Durability and easy maintenance.	Lustron's innate strength and flexibility, resistance to chemicals and moisture, and easy cleaning qualities.

MONSANTO
PLASTICS
SERVING INDUSTRY...WHICH SERVES MANKIND

News of the Industry

Reichhold Chemicals, Inc., 601 Woodward Heights Blvd., Ferndale Sta., Detroit 20, Mich., has purchased 680 acres at Tuscaloosa, Ala., 21 acres at Elizabeth, N. J., 5 acres at South San Francisco, Calif., and 110 acres at Philadelphia, Pa. This acreage will afford sites for additional plants devoted to the production of synthetic resins, chemical colors, phenolic plastics, to new chemical developments.

J. D. Lippman president of **Textileather Corp.**, Toledo, Ohio, has announced permanent termination of the contemplated consolidation of Textileather Corp. and the **Pantasote Corp.**, Passaic, N. J. Plans for the merger were revealed in August, 1946. However, both companies will now continue independent operation as heretofore;

Plans to more than double the production capacity of **The Glenn L. Martin Co.'s** new chemical plant, now under construction near Painesville, Lake County, Ohio, have been approved by the board of directors. Expansion for the plant, which will produce Martin Marvinol resin, calls for an increase from 11 to 25 million lb. annual capacity and an increase in construction cost from $1,500,000 to $3,000,000.

James M. Nicely, vice-president of the Guaranty Trust Co. of New York City, has been elected to the board of directors.

Stack Plastics has opened a new plant at 2105 Colorado Ave., Santa Monica, Calif. Additional services are flock finishing, gold foil stamping, automatic drawing of light gage plastic sheet, automatic fabrication.

The Standard Chemical Co., Akron, Ohio, has made available to rubber and plastics compounders a new series of coloring materials called Stan-Tones. These colors are supplied only as masterbatches of coloring pigment dispersed in a plasticized resin. They are compatible with natural rubber, every type of synthetic rubber, vinyl resins and other types of thermoplastics.

Bradley & Vrooman Co.'s Sterilkote, lacquers and paints which have a Vinylite resin base, are now being used as a protective coating on the tanks and splash boards of X-ray developing machines. Applied as a finish, this plastic surface is said to furnish a continuous protective coat that withstands the constant attack of the solutions used and washes clean from stains with no change in efficiency. This is but one of the uses of Sterilkote which is also being used by certain manufacturers of metal shipping containers and builders of tanks for holding and transporting beverages as an odorless, tasteless and non-toxic lining. Company headquarters are in Chicago, Ill.

The committee planning the 1947 National Plastics Exposition to be held May 6 to 10 at the Coliseum in Chicago has decided to restrict attendance at the show to members of the industry and prospects for the industry's products. Those eligible for admission to the Exposition will be the direct customers, defined as those that would logically be called upon by the salesmen of the majority of exhibitors.

Admission will be by registration only, with all persons required to establish a trade relationship to exhibiting companies. There will be no charge or registration fee.

The hours of showing will be from 1 p.m. to 6 p.m. all days but Friday when the exhibit will remain open until 10 p.m.

Concerted trade agreement negotiations between the United States and 17 other nations for the reciprocal reduction of trade barriers and substantial elimination of trade discriminations among participating nations will begin in the spring of 1947, probably at Geneva, according to an announcement made by **Dean Acheson,** Acting Secretary of State, in Washington, on Nov. 9,

At the same time, the Acting Secretary made available to the public a list of products which will be considered for the possible granting of tariff concessions by the United States in the negotiations.

Manufacturers and other business men who favor or oppose inclusion of these products in trade agreement negotiations are urged to participate in public hearings which will be conducted by the Committee for Reciprocity Information. These hearings will begin at 10 a.m. on Jan. 13, 1947, in the Department of Commerce Auditorium, 14th and E Sts., Washington, and last approximately six weeks.

Applications to be heard and submission of briefs had to be made by Dec. 21.

This is the largest reciprocal trade agreement negotiation ever undertaken. The nations involved account for about two-thirds of the world's trade. They are: United States, Australia, Belgium, Brazil, Canada, Chile, China, Cuba, Czechoslovakia, France, India, Lebanon (Syro-Lebanese Customs Union), Luxembourg, Netherlands, New Zealand, Norway, Union of South Africa, United Kingdom.

H. V. Walker Co. of Elizabeth, N. J., has developed a new high-grade enamel, Porciflex, with a synthetic resin base of the alkyd melamine type. This Porciflex has been used mainly on metal. It is also adaptable as a covering on plastic material. It can be employed as a finish in the automotive industry, for kitchen cabinets, refrigerators, medicine cabinets, hospital equipment, fluorescent fixtures, signs, costume jewelry.

Available in clear, black, white and all colors, the enamel is said not to crack or flake when struck and not to peel off under normal conditions. Applied to sheet steel, it can be bent to an 180° angle without flaking.

Porciflex, which is applied by spray, roller-coating machine or dip, is baked at schedules from 1 min. at 450° for sheet steel to 15 min. at 275° for other types of work. It is adaptable to infrared baking.

Arnold Brilhart Ltd., 435 Middle Neck Rd., Great Neck, L. I., N. Y., has moved into its new plant on Old Country Road, Mineola, L. I., N. Y. The new plant area is about 70,000 sq. ft., an expansion of 700 percent over the old location. Molding and tooling room capacity has been increased and the following segregated departments have been set up: injection molding, compression molding, mold making, heat treatment, fabricating and finishing, lacquer and paint spraying, metal plating, chemical research, shipping and receiving, model making, maintenance and in addition, steel fabricating and inspection.

Werner Molded Plastics Co. has set up sales and advertising offices at 295 Fifth Ave., New York City. A division of the R. D. Werner Co., Inc., manufacturers of the Chromtrim line of metal moldings, the firm has its manufacturing facilities at Long Island City, N. Y.

National Merchandisers, 28 E. Huron St., Chicago 11, Ill., has announced a Marketing Service for new inventions. The purpose of the new division will be to help the small or average inventor at every

step and much of the firm's activity will be centered around engineering analyses, market surveys and invention sales.

Plastic Studio, Inc., 2509 Library Rd., Pittsburgh 1, Pa., was organized last summer by D. L. Mitchell, formerly educational director at Pittsburgh School of Plastics and U. S. Office of Education plastics instructor in plants holding war fabrication contracts, to specialize in exclusive designs in cocktail, coffee, end and lamp tables and a line of display fixtures. Other firm members include: L. D. Mitchell, plastics designer; George A. Elles and Herman E. Krupa.

Di Machine Corp., a division of the **Diebel Die & Mfg. Co.** and manufacturer of the Diebel Hi-Speed Automatic Punch Press, recently completed a new daylight factory at 2711 W. Irving Park Rd., Chicago, Ill. The new factory provides space for increased production of the small press and for manufacture of tools, dies, stampings, radio parts.

Cro-Micron Process & Research Corp., 180 Mulberry St., Newark 2, N. J., has announced a new development in the electro-disposition of metals—the disposition of rhenium metal directly upon any base metal, much the same as other metals are now plated. Rhenium, element number 75, has qualities which make it excellent for acid-resistant dies, machine parts, apparatus, etc. It will resist any dilution of either hydrochloric or hydrofluoric acids. It has a melting point of 3167° C. and will not react with nitrogen at 1000° C.

The American Injection Molders, Inc., Long Island City, N. Y., has been organized and is headed by Alfred Axel. The company's new plant was designed and built with a view to future growth and expansion. It has facilities for designing, engineering, mold making, molding, assembling and packaging for distribution.

The Diamond Tools Committee of the Industrial Diamond Association of America, in line with a movement initiated by the National Bureau of Standards, has met with representatives of machinery manufacturers to discuss possibilities for simplifying the use of diamond tools for economy to users. The Association is also surveying all its tool-making members to determine what abuses there are in the use of diamond tools and the best methods of obtaining maximum utility.

The Connecticut Hard Rubber Co., 407 East St., New Haven 9, Conn., has introduced a new type of insulating tape and sheeting made by coating Fiberglas with Silastic. The material provides a rubber-like sheeting resistant to temperature up to 500° F. Its resiliency makes it an excellent gasketing material for use at high temperature. It is said to have a high dielectric strength running approximately 500 volts per mil, be water resistant, water repellent, not affected by ordinary oils or chemicals and have a resistance to sunlight and ozone. It can be molded or extruded into any required shape and can be applied as a coating for glass cloth, metal or wire. The material is useful as an electrical insulating material and as a bonding material in laminating of glass or asbestos cloth.

Sun Plastic, Inc., 2834 Vincent St., Cuyahoga Falls, Ohio, has been formed to engage in the manufacture of molds and molded products. Officers and partners are: R. A. Brown, president; A. D. Grafton, vice-president; F. Rohrbaugh, secretary-treasurer; P. G. Cline, foreman of the Mold Div.; F. H. Borchers, foreman of the Plastic Div.

Plasti-Line, Inc., plastic fabricators, has moved to its new building, Jacksboro at Broadway in Knoxville, Tenn. The firm was launched 26 months ago with the manufacture of puzzles. Now it fabricates numerous items for home, commercial and industrial use.

The M & L Plastic Corp. of Easthampton, Mass., has been organized and will specialize in custom injection molding.

The name of **Gustavus J. Esselen, Inc.**, 857 Boylston St., Boston 16, Mass., was changed to **Esselen Research Corp.** on November 1. Its services include product improvement, process simplification, research and development programs, evaluation of processes and products.

Rhodes Industrial Corp. has been formed with offices and laboratories in East Hampton, N. Y. The new corporation will engage in the development and manufacture of fine chemicals and synthetic resins. Officers are: Philip H. Rhodes, president; Alfred L. Alk, treasurer and chief chemist; Ernest Libby, director of resin-pilot plant.

Queen Products, Inc., has taken over the assets and liabilities of Craven & Whittaker Co., injection molding concern at 215 Georgia Ave., Providence 5, R. I.

Duo Plastics, specializing in compression molding and located at 227 West 64th St., New York, N. Y., has been formed by Dixey Barry Carr and Herman Strully. Mrs. Carr, who has been in the glass-animal business for the past seven years, will continue this concern as well.

Koppers Co., Inc., Pittsburgh 19, Pa., has completed negotiations with the Office of Rubber Reserve for the purchase of the styrene facilities at the large synthetic rubber plant at Kobuta, Pa. In addition, four butadiene units at Kobuta are being maintained in standby condition for the government by Koppers.

Creative Fabrics Corp., manufacturers of plastic film and patent plastics, has moved from 1450 Broadway, New York, N. Y., to larger facilities at 23 W. 23rd St.

A Product Design and Development Div., headed by G. Henry Van Veen, has been established by **Oakes & Co.**, Chicago, Ill. This new division enables the company to offer manufacturers product and package design as well as national distribution and merchandising.

Eureka Laboratories, Inc., formerly the **Laboratory Div. of Southwestern Plastics Co., Inc.**, has been formed with offices and laboratories at 4615 Marcus St., Dallas 5, Texas.

Tilco Limited, established by Tilton & Cook Co., of Leominster, Mass., is building a factory at Peterborough, Ontario, Canada. The new plant will be used for the manufacture of plastic combs, hair pins, barrettes and other plastic merchandise. Officers are: George H. Cook, Jr., president; Roger Earle, vice-president; Ronald Earle, assisted by Donald Hunter, as secretary-treasurer.

Fischer & Porter Co. of Hatboro, Pa., manufacturers of variable area type flow rate instruments, heretofore called Rotameters, has adopted the trademark name Flowrator to designate the product of its manufacture.

Personnel changes

J. Douglas Kirk has been placed in charge of the sale of thermosetting molding material in northern New England for the Plastics Div., Monsanto Chemical Co., 600 Monsanto Ave., Springfield 2, Mass. **Winston Richter** will handle the sale of thermoplastic materials. In southern New England, **William H. Face** will be in charge of the sale of thermoplastic materials and **T. J. Martin**, thermosetting materials.

At the same time announcement was made of the appointment of **Edwin L. Hobson** as assistant branch manager of the New York office of the Plastics Div.

Ralph Kruck, industrial designer, is moving his offices from Springfield, Mass., to Blaisdel Point, Clinton, Conn.

Joseph H. Fulmer, formerly with the Ethyl Corp. and Sharples Chemicals, has joined the Engineering Dept., Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

Harry D. Randall, formerly with the Plastics Div., General Electric Co., has joined William L. Marshall, Ltd., 425–433 E. 10th St., New York City, as vice-president.

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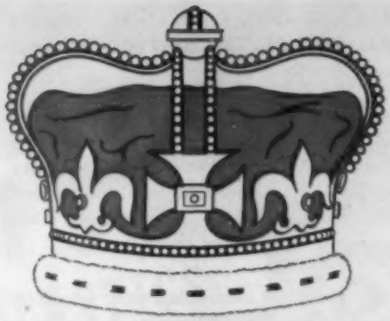
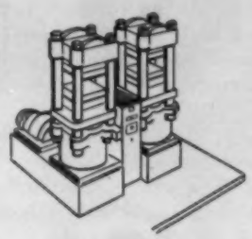


COMPACT

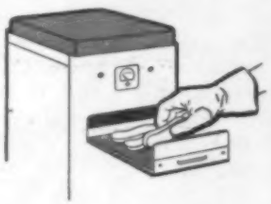
Occupies only 3 square feet of floor space. You wheel this THERMEX Red Head into your present press layout, plug into standard power line, and start production.



VERSATILE

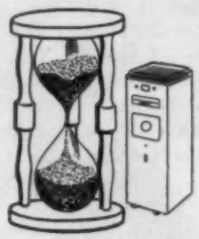
Can be used to keep several presses busy. Dual timers permit heating of two different charges in any sequence. Operator simply flips selector switch for any desired time.

Model 1R1A



SIMPLE

Anyone can operate it. Preforms are put into the famous THERMEX Drawer. High frequency power starts when drawer is closed. Automatic timer cuts power when preforms are ready.



DEPENDABLE

Rugged construction and sound electronic design assure years of service under severe operating conditions. Automatic devices offer every possible protection against equipment failure.

Queen of the Thermex Red Heads

Aces in high frequency heating for plastics

THERMEX pioneered in the development of high frequency equipment for preheating plastic materials. Starting with the application in its infancy, THERMEX electronic engineers have learned through outstanding field experience.

This new THERMEX Red Head embodies all that has been learned. For size in relation to capacity, it provides more plastics preheating service more efficiently than any other equipment.

Although extraordinarily compact, it takes preforms weighing up to ¾ lb. and, in a minute or less, uniformly heats them to just the right degree for free flow in the mold. Closing pressures are reduced as much as 80%. Pin breakage is minimized. Rejects are reduced. Production is upped an average 30%—in finished pieces of uniform density, higher gloss, greater strength.

You get *continued* peak performance with this THERMEX unit. Features too numerous to mention here, having to do with its internal "works", assure sustained, trouble-free, foolproof, full-time operation. For complete technical details write for THERMEX BULLETIN 1R1A. The Girdler Corporation, Thermex Division, Louisville 1, Kentucky.

District Offices: 150 Broadway, New York 7, N. Y.
228 N. LaSalle St., Chicago 1, Ill. • 1836 Euclid Ave., Cleveland 15, Ohio

Thermex RED HEADS

THERMEX and RED HEAD—T. M. Reg. U. S. Pat. Off.

THE FIRST INDUSTRIAL HIGH FREQUENCY DIELECTRIC HEATING EQUIPMENT

Marshall M. Smith has been elected president of the E. W. Bliss Co. His offices will remain at the company's executive offices, 450 Amsterdam Ave., Detroit 2, Mich. An international organization founded in 1857, the company supplies mechanical and hydraulic presses, can, container and drum-making machinery.

Chris J. Groos, vice-president of the Boonton Molding Co., Boonton, N. J., and his wife who were seriously injured in an automobile accident near Wooster, Ohio, Nov. 7, are now recovering at their home in Mt. Vernon, N. Y. Mr. Groos is expected to return to work sometime in January.

Lawrence L. Jones, formerly foreman of the varnish section, Resin and Insulation Div., General Electric Co., at Schenectady, N. Y., has been named superintendent of G-E's new factory for the manufacture of glyptal alkyd resins at Anaheim, Calif.

Dr. Ralph H. Ball, assistant technical director of the Plastics Div. of the Celanese Corp of America, Newark, N. J., has been elected chairman of the American Chemical Society's Paint, Varnish and Plastics Div. He succeeds **Dr. Adolph C. Elm** of the New Jersey Zinc Co.

Donald A. Bunce has been appointed manager of the new Burlington, N. J., chemical plant of Hercules Powder Co., 921 Market St., Wilmington, Del. This plant, which will produce synthetic resins and other chemicals, is scheduled for completion this month.

Henry A. Thouron has been appointed assistant to the director of sales of the Synthetics Dept.

C. Robert Moulton, B.S. Ch.E., Ph.D., has joined the staff of Bjorksten Laboratories, industrial research chemists at 185 N. Wabash Ave., Chicago 1, Ill., as a research associate.

George DeBell has moved his consulting offices from the Gurley Bldg., Stamford, Conn., to 1380 Bedford St. in Stamford.

H. J. Leisenheimer has been appointed director of export sales of the Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio. Mr. Leisenheimer was formerly executive vice-president of the Cleveland Tractor Co.

Francis F. Braun, industrial designer, has been named head of the Product Development Div. of Burton-Rodgers, Inc., 4527 Reading Rd., Cincinnati 29, Ohio.

William C. Appleton, who recently resigned as president and director of the American Viscose Corp., has accepted the office of president and director of Selectronic Dispersions, Inc., 98 Greenwood Ave., Montclair, N. J. He succeeds **Raymond M. Tierney** who was elected secretary-treasurer.

Simon Askin has been appointed director of purchases for the Heyden Chemical Corp., 393 Seventh Ave., New York City, to succeed **Robert P. Gould,** retired. Mr. Askin is also assistant secretary and assistant treasurer of the company.

Edward M. Linford has been appointed head of the Design Section of the Model Shop, Rohm & Haas Co., at Bristol, Pa. He replaces **Henry F. Pearson** who resigned to act as an independent design consultant on applications of Plexiglas, to execute edge-lighted murals and to undertake similar special design problems involving Plexiglas.

Ben Verson, formerly treasurer of Shellmar Products Corp., Mt. Vernon, Ohio, has been appointed general manager of the Shellmar Division.

Dr. E. J. Jacob has recently joined the research staff of Plastics Guild Corp. of Paterson 4, N. J., and New York City to assist in an expansion program.

Meetings

Dr. R. B. Akin, E. I. du Pont de Nemours & Co., Inc., discussed plastics applications, with emphasis on nylon and polyethylene, at the eighth session of the course in plastics for retailers, sponsored by S.P.I. and New York University, Nov. 25. At the Nov. 18 session, **Dr. Robert J. Moore,** of Bakelite Corp., described production of phenolic molding materials and their uses in telephones, housings and other applications; **Dr. M.H. Bigelow,** of Plaskon Div., Libbey-Owens-Ford Glass Co., outlined the background and identification of the aminos—both urea and melamine formaldehyde.

The Miami Valley Section of the Society of Plastics Engineers met in Dayton, Ohio, Dec. 5. **Fred Connally,** public relations director of Bakelite Corp., was guest speaker.

The Plastics Engineers Association met at the Yale Club, New York City, on Nov. 18 and heard **Edward H. Decker,** of Owens-Corning Fiberglas Corp., discuss the role of Fiberglas in plastics.

New industrial products and engineering techniques were highlighted in many of the 200 odd technical papers at the 67th annual meeting of the American Society of Mechanical Engineers held at the Hotel Pennsylvania, New York City, the week of Dec. 2. Advances made in rubber and in plastics in the last year; new trends in aircraft design; a symposium on weight savings in passenger cars that presages lighter and faster trains; new products of wood and metals were among subjects discussed in some 80 technical sessions conducted during the meeting.

The Hartford-Springfield Chapter of the Society of Plastics Industry held its fall meeting at the Hotel Sheraton, Springfield, Mass., on Nov. 26. **Milton H. Glover,** vice-president of the Hartford National Bank & Trust Co., discussed the bank's part in financing a business and **Dr. R. B. Akin** of E. I. du Pont de Nemours & Co., Inc., discussed recent nylon developments.

Robert A. Cooper, chairman of the Pacific Coast Section of S.P.I., has announced that the 1947 annual meeting of the Section will be held March 27 and 28, probably at the Biltmore Hotel in Santa Barbara, Calif. **R. B. Gutsch** has been appointed conference chairman and **Ralph David** has been named publicity committee chairman.

The Newark Section of S.P.E. held a dinner meeting Dec. 11 at the Newark Athletic Club in Newark, N. J., and heard the following speakers: **Henry W. Harding,** president of Chemaco Corp., on "Why ethyl cellulose" and **J. H. DuBois,** executive engineer of Shaw Insulator Co., on "Selling high frequency preheating equipment."

The Northwestern Pennsylvania Section of S.P.E. met at the Hotel Kenyon, Erie, Pa., on Nov. 12. **Joseph A. Hill,** designer with Barnes & Reinecke, Inc., talked on "The approach of the industrial designer."

The Cleveland Section of S.P.E. held a Holiday Party at the Richmond Country Club in Cleveland, Ohio, on Dec. 13.

The Central Ohio Section of S.P.E. held a dinner meeting at New China Inn in Zanesville, Ohio, on Nov. 22. **Charles Jones** of Owens-Corning Fiberglas Co. showed two movies on the application of low pressure contact resin and Fiberglas in airplane construction.

The Buffalo Section of S.P.E. heard a discussion of the new Mathieson plastic, polydichlorostyrene, at a meeting held Nov. 22 at the Hotel Westbrook. **Lawrence E. Russell** of the Niagara Falls Div., Mathieson Alkali Works, spoke.

The Chicago Rubber Group held its annual Christmas Party on Dec. 20 in the Terrace Casino of the Morrison Hotel, Chicago, Ill.

The Philadelphia Chapter of S.P.E. held a joint meeting with the S.P.I. at Franklin Institute on Dec. 9. **Rene Bouvet** of the Viscose Co., Marcus Hook, Pa., spoke on rayons, synthetic yarns, natural and other materials used in making cloth. At a

similar meeting on Nov. 18, speakers were: **Thomas D. Perry**, Resinous Products & Chemical Co., who spoke on wood; **William Darling** of Riegel Paper Co., who discussed paper and **Junius D. Edwards**, Aluminum Company of America, who spoke on aluminum.

The Institute of Polymer Research at the Polytechnic Institute of Brooklyn, New York City, in a symposium which it sponsored on Nov. 30, presented a series of talks on new developments in research to assure more durable synthetic products which would be heatproof, shatterproof, crackproof and kinkproof. **Dr. A. V. Tobolsky**, assistant professor of chemistry at Princeton University, was chairman of the symposium, which was the second in a series of eight symposia on the recent progress in the field of high polymers.

The program follows: "Structural and chemical aspects of vinyl and diene polymers" by **R. B. Mesrobian**, Princeton University; "Degradation and light aging of polystyrene and polyvinylidene chloride" by **R. F. Boyer** of Dow Chemical Co.; "Mechanism of inhibition" by **C. C. Price** of Notre Dame University; "Anti-oxidant effect in natural and synthetic rubbers" by **G. H. Smith** of the Firestone Tire & Rubber Co. and "The role of oxygen in the degradation of elastomers" by **A. M. Neal** of the Rubber Section of E. I. du Pont de Nemours & Co., Incorporated.

The Boston-Providence Chapter of the Society of Plastics Industry met in the Raleigh Room of the Sheraton Hotel, Boston, Mass., Dec. 9. **Dr. R. B. Akin** of E. I. du Pont de Nemours & Co., Inc., discussed recent nylon developments.

The Detroit Section of the S.P.E. presented its first "problem forum" at a meeting at Rackham Memorial, in Detroit, Oct. 25 and heard **Charles A. Franz**, American Plastics Engineering Corp., talk on "Estimating manufacturing costs and establishing selling prices." Members of the forum panel were: **John Mickey**, Ford Motor Co., chairman; **John Totten**, Ford Motor Co.; **William Bradley**, Detroit Macoid Co.; **L. L. Lamb**, Durite Plastics Co.; **Harry Klein**, Reichhold Chemical Co. and **Jack Morrison**, Detroit Mold Engineering Co.

The New York Section of the Society of Plastics Engineers met in the Sheraton Hotel, New York City, Nov. 19. **George K. Scribner**, president of Boonton Molding Co. and chairman of the board of directors of S.P.I., spoke on labor relations —the problems of the foreman in the shop, as well as those which are encountered by higher company management.

Sorry!

Due to an oversight we failed to mention that the article, "Techniques of extruding acrylics" by James Bailey of the Plax Corp. appearing on pages 131 through 139 of our December 1946 issue was delivered during the annual meeting of the New England Section of S.P.I. at Manchester, Vt., held Oct. 17 and 18.

Detailed program for S.P.E. Convention

Additional program details for the third annual national plastics show of the Society of Plastics Engineers, to be held on Chicago's Navy Pier from Jan. 25 through Jan. 31, have been announced by J. O. Reinecke of Barnes & Reinecke, Inc., general chairman, and other officers and committee chairman. Special exhibits, to supplement the dozens of commercial displays, will include the Rohm & Haas Co. "Dream suite," a plastic fuselage for a BT-13 military airplane exhibited by the Army Air Forces, and numerous activated displays. A style show and home utilities show will be among other features.

William L. Hess, Anesite Co., chairman of the meetings committee, announced that more than 20 speakers had accepted invitations to appear before the technical sessions at the Congress Hotel, extending from Jan. 27 through Jan. 31. Speakers and their subjects were listed at press time as follows:

S. K. Moxness, Minneapolis-Honeywell Regulator Co., "Live steam preheating"; T. W. Noble, Fabricon Products, Inc., "Molded laminated products"; R. V. Beshgetoor, Radio Corporation of America, "Molding television lenses"; E. E. Ziegler, Dow Chemical Co., "Plastics mold release"; Donald Gibbs, Dow Chemical Co., "Thermoplastic problems"; R. J. Metzler, Hercules Powder Co., "Thermoplastic laminates"; Edward Borro, Durez Plastics & Chemicals, Inc., "Thermosetting fundamentals"; Wayne F. Robb, Shaw Insulator Co., "Auxiliary plunger transfer molding"; G. A. Albert, National Vulcanized Fibre Co., "Vulcanized fiber as an engineering material"; A. J. Warner, Federal Telephone & Telegraph Co., "Polytetrafluorethylene"; R. L. Foote, Synthane Corp., "Laminates—their basic position as materials of engineering"; T. N. Willcox, General Electric Co., "Dielectric preheating"; John Sasso, Business Week Magazine, (statistics); LaVerne E. Cheyney, Batelle Memorial Institute, "Plastics in aircraft—a record and a challenge"; E. H. Bucy, Atlas Powder Co. (coatings); J. W. Knight, Fabri-Form Co. (fabrication); S. M. Shobert, Motor Tool Manufacturing Co., "Production and fabrication of low pressure resins"; William H. Aiken, Goodyear Tire & Rubber Co. (coatings); W. R. Thompson, Catalin Corporation of America, "Cast phenolic resins"; C. R. Simmons, Durez Plastics & Chemicals, Inc., "Liquid phenolic casting resins"; John Delmonte, Plastics Industries Technical Institute, "Influence of curing conditions and catalysts on properties of cast polyester resins" and also "Physical properties of resin-gypsum castings."

just like their mother!

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MOLDING POWDERS

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Polyvinyl ethers

(*Continued from page 160*) The acetals are removed from the bottom of the column for the methyl and isobutyl products and from the top for the ethyl product. The acetals are saponified in a discontinuous process to recover the alcohols. The aldehyde produced is distilled off, the alkali neutralized, the alcohol layer separated and distilled.

The crude vinyl ether distillate containing 500 kg. vinyl ether and 50 kg. alcohol is washed with water. It is pumped to a reservoir at the top of the washing tower to get the necessary head for gravity feed. It enters the washing column at the bottom and is brought into contact with soft water at 5° C. For distillate containing 500 kg. of ether and 50 kg. of alcohol, 1000 kg. of water are employed. The wash water containing the alcohol is run off at the bottom to a distilling unit. In the case of the isobutyl ether, the isobutyl alcohol azeotrope is run to a separator and the isobutyl alcohol is transferred to a drying distilling column. Water comes off at the bottom of the first column and isobutyl alcohol at the bottom of the second column.

The washed vinyl ether is run through two drying towers containing granulated potassium hydroxide and the pure ether is obtained. Conversion of acetylene per pass is about 60 percent; total yield is as in Table I.

Table I—Yield on conversion of acetylene

Vinyl ether	*Yield based on acetylene*	*Yield based on alcohol*
Methyl, percent	95	90–92
Ethyl, percent	92	92
Isobutyl, percent	95	95

Oppau process for vinyl isobutyl ether

At Oppau, vinyl isobutyl ether is made by a batch process.[4] Acetylene is passed through a mixture of 95 parts isobutyl alcohol and 5 parts sodium isobutylate in a tower 7 meters high and 50 cm. in diameter, holding a charge of 1600 kilograms. The reaction takes place at 120° C. and 20 atmospheres pressure for 8 hours. The product is washed at room temperature in a ring-packed tower with water to remove alcohol. The washed product is boiled under a nitrogen blanket with dry caustic. It is then distilled in a batch still with an unpacked column to separate the 90-percent vinyl isobutyl ether from the higher boiling ether impurities. All distillation is carried out under a nitrogen blanket to avoid explosion hazard. The still pot is held at 90 to 95° C. and the product goes to a tube condenser. If

[4] "The German Plastics Industry," by J. M. DeBell, W. C. Goggin and W. E. Gloor, Quartermaster Corps. Report PB 562.

An all-purpose buffing compound

An answer to acrylic buffing problems is offered by the Great American Color Co., Los Angeles 6, Calif., in its new buffing compound which can grind, polish and wax in one operation. This finish is said to be good enough for 90 percent of all commercial articles.

According to Morton Schwartzmen, who perfected Gamco, it has an affinity for all types of buffing wheels, comes off the material being buffed easily, does not soften or burn the plastic and is capable of fast action so important to mass production fabrication.

Favorable reports have come from fabricators testing the compound. Instead of smearing on the buffing wheel, Gamco melts into the folds of cloth and feeds out. In one test, the plastic was ground down at the rate of $^1/_{22}$ of an in. per sec. on a right-angle corner held at 45° to the buffing wheel. Small bevels, rounded corners and curved contours can also be tooled.

A soft, open-type cloth buffing wheel run at a surface speed of 3000 to 3500 ft. per min. is recommended. The centrifugal force at faster speeds may make it difficult to apply without undue waste while slower speeds may cause the polish to appear duller. For best optical results it is suggested that the surface of the buffing wheel be kept smooth by carding it with a wire brush or coarse emery paper while in motion.

For heavy duty work on flat or beveled edges, the wheel should be caked solidly with the compound which melts onto the wheel at approximately 180° F. At that temperature it can be pressed down into the layers of cloth with a flat piece of plate glass.

In the polishing of rods, lathe turnings and rounded contours, soft fluff wheels with a light glazing of the compound evenly applied eliminates the possibility of leaving flat spots. Care should be taken to keep an ample supply of the compound on the wheel for the cloth wheel alone may burn the plastic. Gamco's chocolate color helps the operator see when there is sufficient compound on the cloth and when more should be applied. The color can also be seen in the plastic assuring that no particles are left which might complicate subsequent cementing and dying operations. Although developed primarily for polishing acrylics, it is being tested for use on other plastics, silver, brass and steel.

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the first distillation product still contains polymer, it is again distilled. The refined product is then put in a reflux pot with 15 to 20 kg. of sodium metal chips per 600 liters and refluxed to remove the last traces of water, giving a pure ether. The sodium is left in the pot and used to dry several charges.

Batch polymerization of vinyl ethers[3]

Bulk polymerization is the most important process. It is not possible to polymerize in aqueous dispersions because the ethers are saponified by acids. Only materials of low K-values[5] are obtained by polymerization in solution at elevated temperatures.

An enameled or stainless steel kettle equipped with a 25-kw. stirrer is employed. Cooling capacity to −30° C. and heating capacity to 120° C. are provided. The catalyst used is an addition compound of boron trifluoride and 2 molecules of water, made up to a 1 percent solution in dioxane. Production of 1 cu. meter of vinyl ether requires 1.5 liters of boron trifluoride solution.

From 15 to 20 percent of the monomer for one batch is added to the kettle. The methyl ether is cooled to 0° C. to keep it in the liquid state. The catalyst solution is run in, drop by drop, and stirred continually until the reaction starts as indicated by refluxing. The remainder of the monomer and catalyst is added over a period of 1 to 1½ hours. The temperature rises to 15 to 25° C. above the boiling point of the ether. The temperature is then brought gradually to 80 to 100° C. over a period of 5 to 8 hours. After polymerization the residual monomer is distilled off; the yield of polymer is approximately 93 percent. The polymer is a very viscous mass and is run into containers or into a kneader for making solutions.

Continuous polymerization process[4]

At Oppau vinyl isobutyl ether is polymerized by a continuous process. The polymerizer consists of a continuous horizontal web-woven hemp or rayon belt 1 meter wide rolling between two drums 1 meter in diameter and about 9 meters between centers. Oblique idling pulleys spaced at intervals between the drums and underneath the belt edges form its top face into a trough some 6 in. deep. The belt operates with the driving pulleys hub deep in water, at a speed of 1.5 meters per minute. The monomer feed lines lead to a point about a foot above the place where the trough is first shaped on the roll, and the nozzles of the two lines are placed so that the feed will be well mixed upon falling into the trough. A detachable hood fits over the whole belt assembly, being mounted in such a way that a water seal to hold the operating pressure of 250 mm. is maintained. The whole tank is made of steel.

The ether is cooled to −50 to −60° C. and 0.05 percent of dibutyl phenyl sulfide is added as a stabilizer. Propane cooled to the same temperature is added to the ether in a 4:1 ratio.

The catalyst consists of boron trifluoride in propane at −50 to −60° C. The amount of catalyst used depends upon the desired K-values. For a K-value of 50 to 60, 0.055 percent of boron trifluoride, based on the ether, is added. For higher polymers it may be as low as 0.01 percent.

In operation, material at a temperature of −60° C. falls simultaneously from the ether and catalyst feed pipes to the belt. Polymerization takes place almost immediately when the catalyst mixes with the vinyl ether in propane solution. Propane rapidly boils off, thus controlling the temperature during polymerization. The interior temperature is about 17° C. throughout except around the area where the nozzle feeds meet the belt, which may be colder. Propane is pumped out of the system, washed, dried and re-used.

Propane losses from this system were said to be quite low. The polymerization is practically 100 percent complete, and the product passes along the belt as a spongy mass 4 cm. thick. The polymer is carried into water by the polymerizer belt and is compressed and put on a belt system which takes it out of the water seal, through a washing spray and to a receiver. To remove traces of catalyst, the material is then steamed out in a chamber which is about 3 meters square and 2 meters high.

The steamed product is next taken to riffle rolls (like rubber washing mills) where it is washed and compressed somewhat. The washed material is then compressed on water-cooled polishing rolls which make a sheet 40 cm. wide and 4 to 7 mm. thick. These sheets are dusted with talc and fed to a continuous horizontal wire belt dryer. The dryer is 90 cm. wide and about 30 meters long. Air which has been steam-heated to 120° C. enters the discharge end and leaves the feed end at 40° C. The product takes about 20 min. to go through the dryer, passing to an aluminum cooling band where it is cooled to room temperature. The sheet is here slit into lengths 1.5 meters long and packed into paper bags.

An interesting feature of the Oppau plant equipment is an air-sampling device which continuously measures the propane content of air by infrared absorption, sounding a signal when concentrations reach explosive or physiologically unpleasant levels.

Applications of polyvinyl ethers[3]

The methyl polymer is soluble in water and is used in adhesives and sizings for textiles. In limited amount, up to 25 parts per 100, it is used in polyvinyl chloride lacquers. It is compatible with latex, cellulose nitrate, chlorinated rubber, cellulose butyrate and chlorinated polyvinyl chloride. It is added to rubber latex to aid in coagulation in making dipped articles.

The ethyl polymer is insoluble in water, soluble in alcohols, ethers, esters and hydrocarbons. It is used in adhesives and lacquers. It has limited compatibility with cellulose nitrate and sweats out like castor oil. It is compatible with cyclohexanone resins, shellac,

[5] Fikentscher's viscosity coefficient, k, is calculated as follows:

$$\frac{\log \eta_{rel}}{c} = \frac{75k^2}{1 + 1.5kc} + k$$

where c is the concentration in g./100 cc. of solution and η_{rel} is the ratio of the viscosity of the solution to that of the pure solvent. The K-values are 1000 times the calculated viscosity coefficient.

polystyrene, phenolic resins, chlorinated hydrocarbons, paraffins and bitumen.

The isobutyl ether is insoluble in water, but soluble in alcohols, ethers, esters and hydrocarbons. It is used in adhesives and lacquers. It is not compatible with cellulose nitrate or shellac, but is compatible with rosin-glycerol-maleic resin, cyclohexanone resin, polystyrene, paraffin, bitumen and rosin. So-called Igevin Oils, consisting of vinyl isobutyl ether polymer of K-values 20 and 30, are used as liquors for processing leather for waterproofing and maintaining flexibility.

The octadecyl ether has a softening point of 52° C. Its main application is in high grade shoe polish and creams. It is also used as a lubricant for extruding tubes from polyvinyl chloride when very hard material is required.

Three polymers were produced from vinyl tetrahydro-beta-naphthyl (beta-decalol) ether. The 100-percent beta-decalol derivative (Igevin Z) and the copolymer made with 60 parts beta-decalol and 40 parts isobutyl ether (Igevin ZI) are hard resins used as components in adhesives and soft plastics. They have good solubility in usual solvents and good miscibility with plasticizers and oils. They are compatible with rubber, natural resins, bitumen, paraffin wax and other polyvinyl ethers, but not with shellac. The softening points are 65 to 70° C. for Igevin Z and 70 to 75° C. for Igevin ZI.

The higher softening point resin is also used as a thickener for oils for insulating purposes and high-frequency cables. They are not used as thickeners for general purposes. The resins themselves are brittle and have a molecular weight of 3000 to 4000.

A copolymer made with 80 parts beta-decalol and 20 parts isobutyl ether (Igevin IZR) was designed for use as a washable distemper. It is worked into an emulsion for this purpose, but it was stated to be not as good as oil-bound distemper for weather resistance. It remains streaky and was only used for inside decorative purposes because of bad weathering resistance.

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(*Continued from page 158*)

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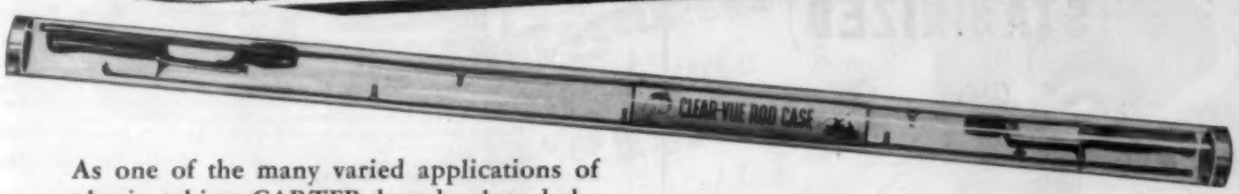

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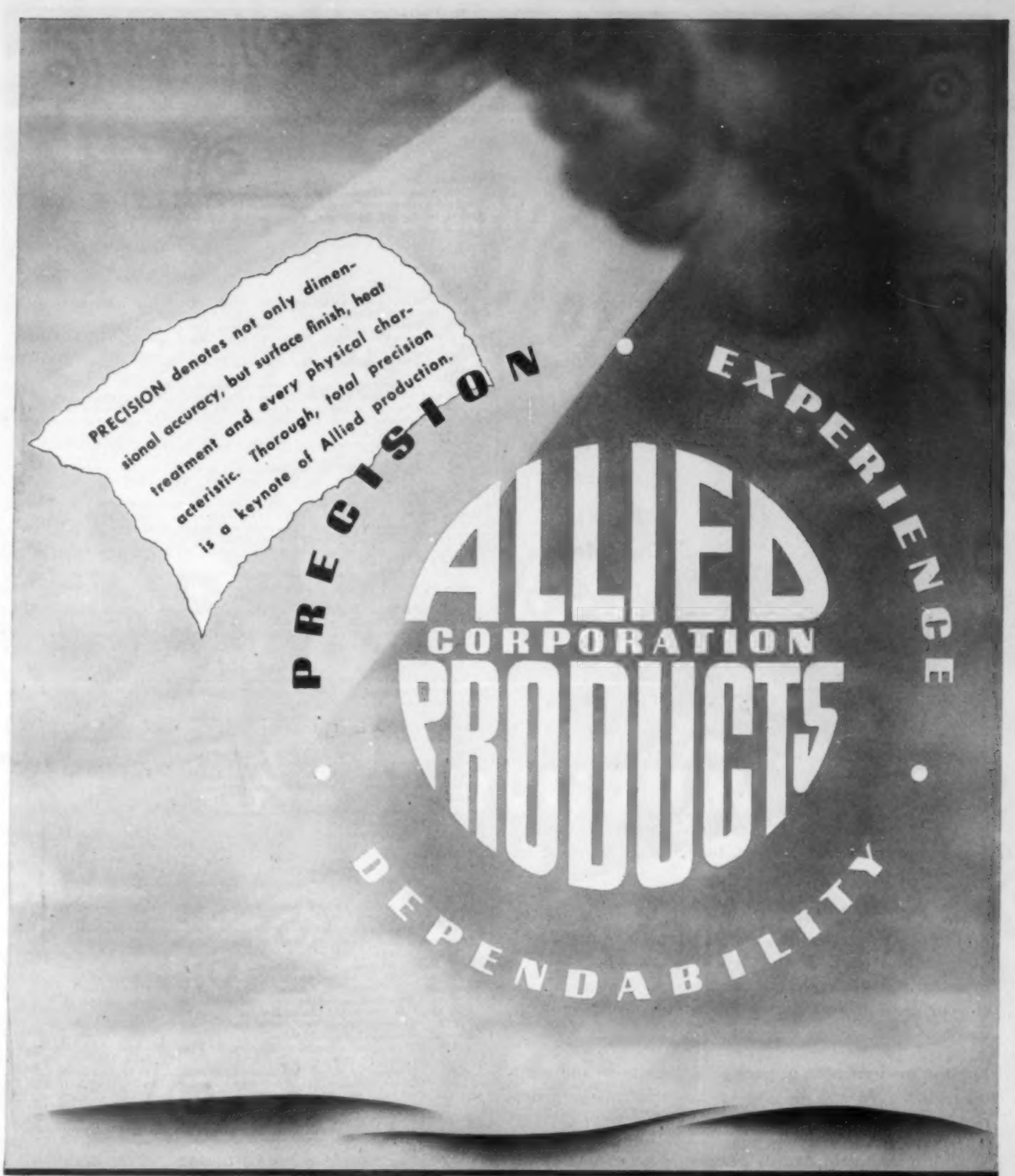

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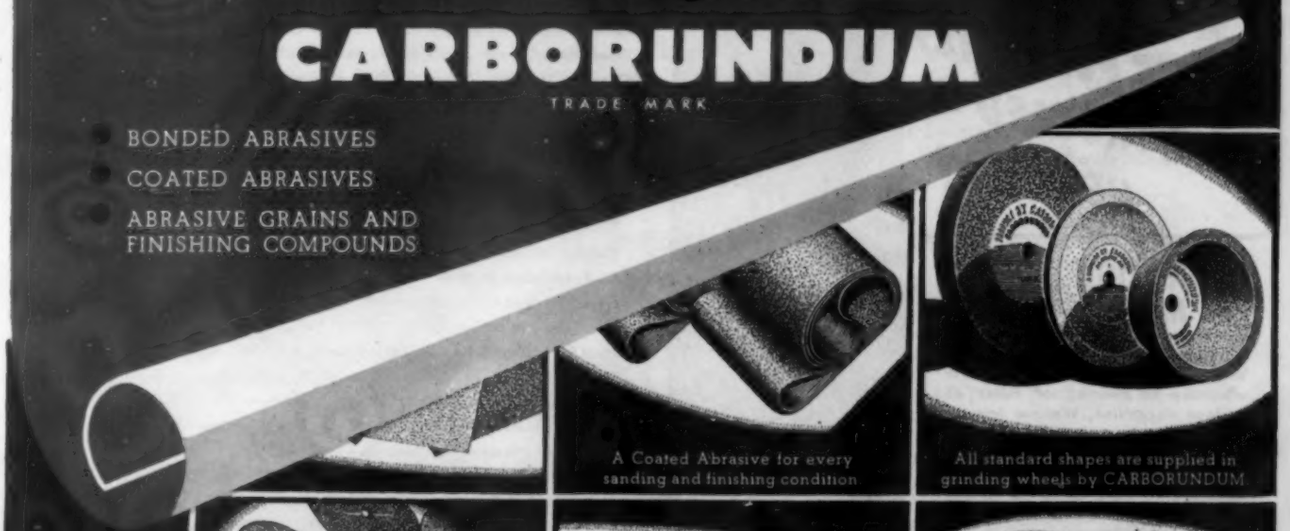

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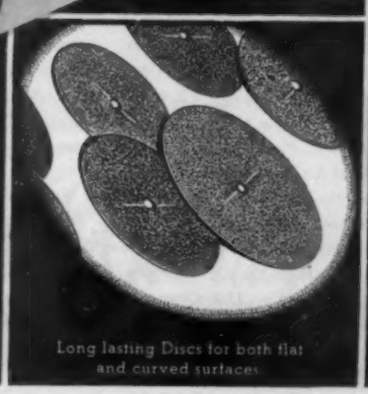

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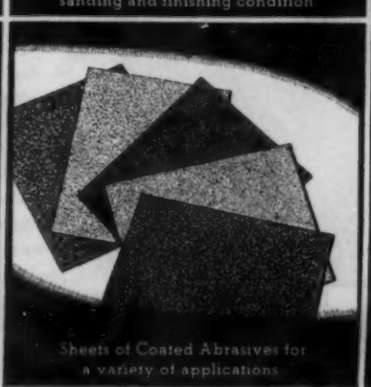

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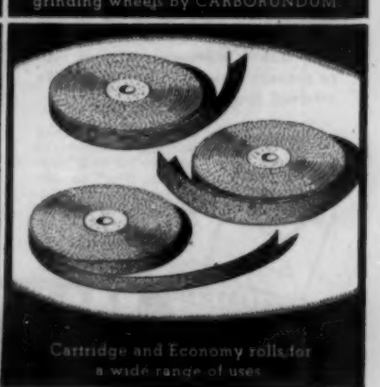

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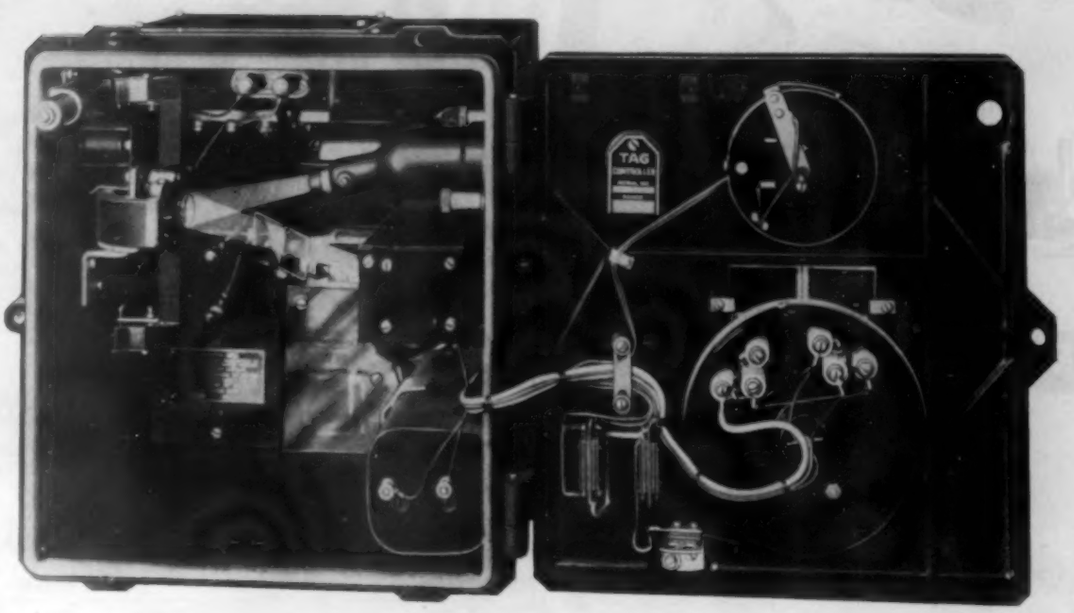

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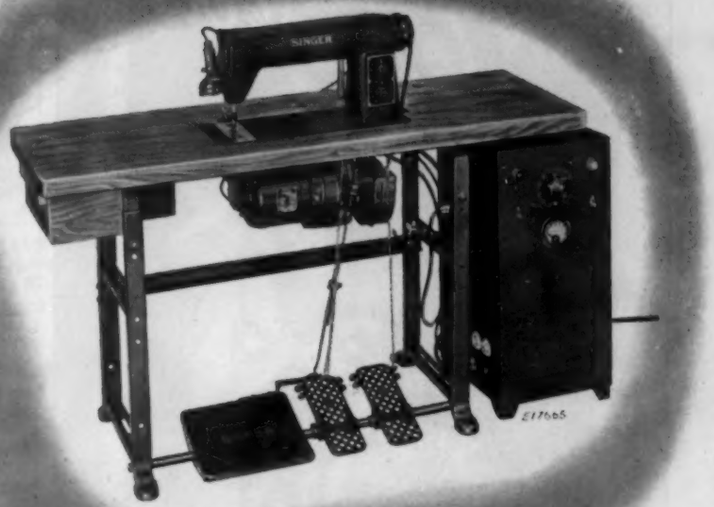

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in the production of Rainwear, Shower Curtains, Powder Capes, Clothes Bags, Aprons, Pouches, Lamp Shade Covers, Dish Covers, Umbrellas and similar articles made of thermoplastic sheet materials. Seams produced are almost invisible and as strong as the material itself.

SEAMING and other thermosealing operations such as hemming, binding, half lap seam felling, tacking, etc., are accomplished on the Singer 248-2 Electric Bonding Machine by the passage of high frequency current through the thermoplastic material as it is moved between two electrodes, one above and one below the material being bonded. The seams produced are not only proof against leakage of water or air; they are stronger than the material itself. They can be made straight or curved, and sharp corners can be made without difficulty.

Widely used already in the fabrication of many consumer articles made of thermoplastic film, the range of usefulness and flexibility of this machine are resulting daily in new applications, especially in the field of rainwear and other waterproof articles where the absence of needle punctures is an advantage.

A technical bulletin describing the operating features of Singer 248-2 Electric Bonding Machine will be sent you on request. Write for it, today.

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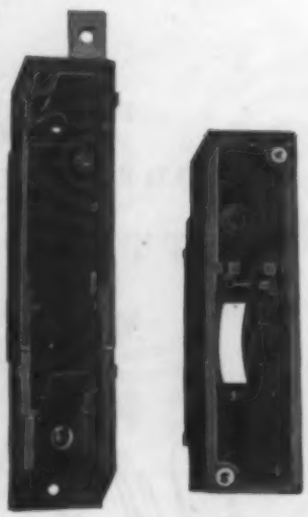
This is an excellent example of clean, accurate molding, with metal inserts in exact position. Tolerances must be close to allow moving parts to function without interference. The "bugs" in this job were ironed out years ago, and the business held by strict and careful attention to the customer's needs.



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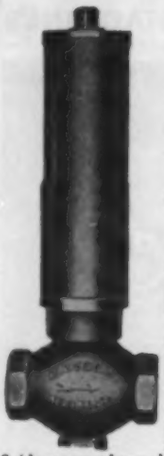

For nearly a half century ATLAS has been making REGULATING VALVES FOR EVERY SERVICE, and that, of course, means plastics plants as well as power plants, chemical, textile, packing, etc. See the partial list of ATLAS products below.

If that list doesn't show the device in which you might be interested, inquire.

What we FEATURE in this publication month after month is our

ATLAS Type "E"
High Pressure Reducing Valve

shown at the left. Exceptionally popular in plastics plants for reducing highest pressures—up to and including 6,000 lb. per sq. in. *without shock*—water oil, or air. All leading plastics plants use it. Every part is modern in every respect. Body is of forged steel. All internal metal parts are wholly of stainless steel. A formed packing of special material superior to leather is used which is immune to all fluids commonly used in hydraulic machinery. The pressure on the seat is balanced by a piston with the result that variations in high initial pressure have little effect on the reduced pressure. Check the list below and mail with your name, firm, and address.

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Particular attention to difficult problems including plastics with metal inserts and other work requiring precision.

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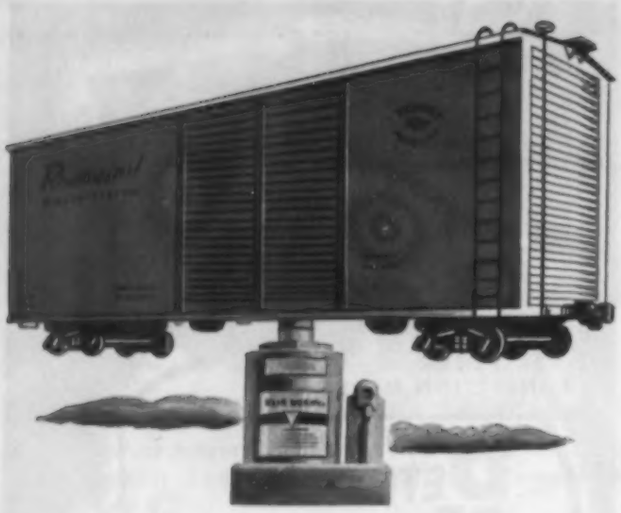

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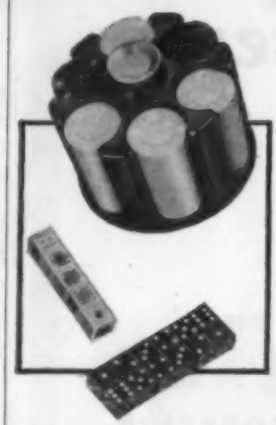
You Name it . . We'll Make it!



1. Many parts and products can be made better and cheaper in moulded plastics. 2. Many existing plastic products can be improved upon.

We invite you to send a sketch, sample or specifications of the product you have in mind. We'll quickly tell you if it can be moulded in plastic.

When you "O.K." our proposal, you have the assurance that your job at Magnetic Plastics will be custom moulded by the finest craftsmen—from the one best plastic material to meet your demand for beauty, durability and maximum sales appeal.

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As custom molders of thermoplastic materials we solicit the most difficult jobs and maintain an engineering service for the development of new products. Our plant capacity has been expanded 400% since the end of the war and we are able to make castings weighing from a fraction of an ounce to one pound; our machine capacity is from four to sixteen ounces. Your inquiries are invited.

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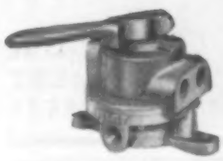
for positive, accurate control . . .



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Hannifin Air Control Valves provide the smooth-acting, positive control of pneumatic cylinder equipment that gets the most from air power. The packless disc-type design insures positive, accurate control, and long service life without leakage or packing maintenance troubles.

This packless disc-type valve design is simple and effective, with the bronze disc which controls air flow ground and lapped to form a perfect seal with the valve seat. Control is smooth and positive. Wear is negligible, and if necessary after long service, the efficient seal may be restored by a simple relapping.

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This know-how saves you time, trouble and money. That's why "it costs you *less* to pay a little more for Sillcocks-Miller quality."

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THE SILLCOCKS-MILLER CO.

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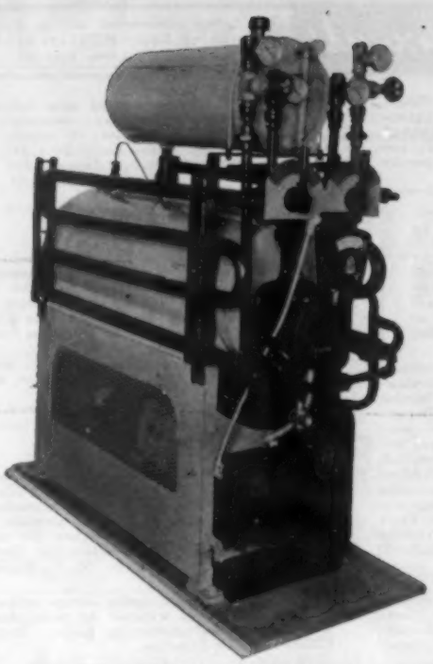
SPECIALISTS IN HIGH QUALITY, PRECISION-MADE PLASTICS FABRICATED FOR COMMERCIAL, TECHNICAL AND INDUSTRIAL REQUIREMENTS.



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WANTED—Salesman in New York area, for custom molding work, injection, extrusion and fabricating. Straight commission only. Reply Box C199, Modern Plastics.

FOR SALE: (1) Watson-Stillman Angle Press, 25 ton each cylinder. $500. (4) Hydraulic presses, 22 x 36, 400 ton capacity 16" ram, 24" stroke, 5' daylight. Price is $1800 each. (1) Watson-Stillman Weighted Type Accumulator $1200. These presses are located at Sal's Press, 386-90 Warren Street, Brooklyn, New York. Delivery is f. o. b. Brooklyn, N. Y. All offers are made subject to prior sale.

FOR SALE: 2—Federal Telephone and Radio Corporation Model MC-3-A Megatherm Dielectric Heating Units, 220 Volt, 3 phase, 60 cycle, complete with Megatherm Dielectric Heating ovens. 1—Defiance #20 Preform Machine, Serial #2022-44, complete with 220 Volt, 60 Cycle, 3 Phase, totally enclosed motor. Molded Products Corp., 4533 W. Harrison St. Chicago 24, Ill.

WANTED
SALES REPRESENTATIVES
Chicago Injection Molder has wonderful opportunity for Representatives in all areas who can do a real job of selling Custom Molded parts. Reply Box C221, Modern Plastics.

FOR SALE—1—12" x 12" Press 7" Ram, Steel Heated Platens and Hand Pump attached; 1—34" x 34" Adamson, 10" ram, 2-opening Hydraulic Press; 1—24" x 24" Farrell, 10" ram, 2-opening Hydraulic Press; 1—30" x 30" D & B, 2-open, steel heated Platens 12" ram; 2—La Pointe Hydraulic Pumps, 150 G.P.M.—2000 lb. pressure direct motor driven to 125 HP AC motors; 1—French Oil Hydropneumatic Accumulator; 1—14" x 24" Press, 9" ram; 4—24" x 55" steel cord Heating Platens; 6—Hydraulic Presses, 20" x 20", 12" x 14"; Dry Powder Mixers; Pulverizers, Grinders, etc. Send for complete list. Reply Box 1545, Modern Plastics.

IN THE MARKET FOR: Stainless Steel or Nickel Kettles, Vacuum Pan, Preform Machine and Mixer, Hydraulic Presses. Reply Box 825, Modern Plastics.

WANTED TO BUY
Phenolic impregnated scrap,
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86 Tremont St., Central Falls, R. I.

WANTED: Small or medium sized plastic molding plant with either hydraulic extrusion or injection equipment with or without tool shop. Advise full details. Reply Box 788, Modern Plastics.

WANTED: PLASTIC SCRAP OR REJECTS in any form. Cellulose Acetate, Butyrate, Polystyrene, Acrylic, Vinyl Resin, etc. Also wanted surplus lots of phenolic and urea molding materials. Custom grinding and magnetizing. Reply Box 318, Modern Plastics.

WANTED:
MIDWEST REPRESENTATIVE
New York Manufacturer of plastic acrylic sheeting that looks like cast phenolics and machines like acrylics. Comes in Many Colors
Want a representative who knows the plastic people. Our men know of this ad. All replies confidential. Reply Box C232, Modern Plastics.

DO YOU NEED a Hydraulic Press for Compression Molding, Transfer Molding, Laminating, Forming, Bending and Hobbing? Whatever it may be, if it is hydraulic, see Sal-Press Company, 388 Warren Street, Brooklyn, N. Y.

WANTED: Technical Sales Representative with well rounded experience in plastics for Eastern territory with headquarters in New York. Excellent opportunity with a newly established plastics division of an old line company. Please give pertinent personal data, including desired salary. Replies will be held in confidence. Reply Box C223, Modern Plastics.

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Sales Engineer—Firm with extensive models, moldmaking and molding facilities, would like a man with established contacts in various fields, who can do a large volume of custom molding business. We have in mind permanent affiliation with such an individual. Reply Box C163, Modern Plastics.

PHYSICAL CHEMIST, Ph.D., wants responsible position in industrial plastics research. Three years in plastics; work in low and high pressure laminates, adhesive and coating formulation; also glass blowing and high vacuum technique; supervisory experience; patents. Demonstrated organizing ability and resourcefulness. Good health, married. Box C224, Modern Plastics.

MOULDS WANTED
Established British Plastic manufacturer is interested in obtaining the use of American or Canadian toy moulds for the British market and would like to enter into an agreement with U.S.A. or Canadian manufacturer for the co-operative use of Moulds (suitable for 8 oz. automatic injection machines or compression 250 tons capacity) on a rental or purchase basis. Particularly interested in model motor cars or aeroplanes.
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Chemist wanted with wide experience in industrial adhesives, specializing in the development and production of Hot Melt Adhesives for paper, plastics and related products. Excellent opportunity with progressive company located near New York City. Submit complete data with application. Reply Box C226, Modern Plastics.

AVAILABLE: Plant Superintendent with twelve years experience in all phases of injection molding and mold design. Will locate anywhere. Reply Box C227, Modern Plastics.

FOR SALE: Angle Molding Hydraulic Press Watson Stillman, suitable for Split Molds, and for Molding Complicated Parts by the transfer method. 3 horizontal double acting rams, 13½", 8" and 6" arranged in "T". Reply Box C132, Modern Plastics.

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lamination of plastics, paper and foils; protective and decorative; packaging. Large well established concern in N. Y. City area. Write Box 483, Suite 617, 1457 Broadway, N.Y.C.

FOR SALE—Watson-Stillman hydraulic preform press, with feed device. Automatic or manual controls. Little used. 200 and 250 ton semi-automatic plastics molding presses, arranged for transfer cylinders. Also hydraulic pumps and valves. Grant Engineering Co., 2640 Prairie Ave., Chicago, Ill.

FOR SALE: Almost brand new laboratory size Pelco Plastic Extruder, complete with ¼" sq. and ⅜" round dies; 6' screw: Two threads per inch. Base size: 21 x 25". Total weight: 600 pounds. Adapted for small commercial jobs. For information, write Box C228, Modern Plastics.

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Young man with engineering education and practical experience to assume full control and direction of the establishment and operation of a new injection molding department for a reliable manufacturer 38 years in business.
Furnish complete information concerning experience, qualifications, and salary expected.
An executive position with a good future assured for the man with initiative and know-how.
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WANTED: 8 or 12 oz. injection molding machine, 2½ inch or large screw extruder, several 100 to 500 ton compression presses. Milling machines, lathe and other die making equipment. Give full particulars including condition, size, price, etc. M. T. Steidl, Box 1663, Fargo, N. Dak.

VINYL resins, plasticisers, scrap, suitable for unsupported film wanted by manufacturer. Any quantities, preferably large. Reply Box C230, Modern Plastics.

FOR SALE: HPM 500 ton Mold. Presses 42" x 48"; D. & B. 500 ton 42" x 48"; 400 Ton 27" x 24"; Wilson 25 ton general shop Presses, downstroke, air and hydraulic operated; also 20 to 250 Tons from 36" x 36" to 12" x 12"; 40 Ton Broaching Press; 400 Ton Extrus. Pr.; W. S. Hor. 4 Plgr. 1" and 2" x 4" H. & L. Pressure Pumps; HPM 1½" x 6" Vert. Triplex 10 GPM 2700 lbs.; 7 Hydr. Oil Pumps, Vickers, Oilgear, Northern, etc.; Elmes 1" x 4" and 1½" x 4" hor. 4 plgr. 5 to 8 GPM 4500 lbs. and 5500 lbs.; Rumsey 4½" x 8" vert. triplex, 65 GPM 900 lbs.; Elmes 2½" x 4" hor. 2 plgr., 17 GPM 850 lbs.; 10 HP horiz. 1½" x 4" triplex 6 GPM 3000 lbs. New Vickers 1½" Oil Relief Valves; New Vickers ¾" Flow Control Valves; Hydr. Steam Pumps; Hand Pumps; Low Pressure Pumps 150 to 600 lbs.; Hydr. Acuum. Heavy Duty Mixers; Roller Conveyor, Mills, Grinders, Pulverizers, Gas Boilers, etc. PARTIAL LISTING. WE BUY YOUR USED MACHINERY. STEIN EQUIPMENT CO., 426 Broome St., New York 13, N. Y. CANAL 6-8147.

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Small Low-pressure LAMINATING PLANT. Ready to operate. 3 presses-Accumulator, Boiler, etc.
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PLASTICS ENGINEER AVAILABLE: 10 years experience. Can follow through from idea stage to manufacture for injection press. Desire responsible position with progressive concern. N. Y. environs. Reply Box C236, Modern Plastics.

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Newly Designed and Built by a Leading Leominster Tool Shop

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STOKES 200 or 300 Ton Press Wanted.

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fully experienced on Reed-Prentice machines. Permanent. Good paying position for qualified men.
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25 Ton "C" Frame Type High Speed Self Contained Hyd. Press.—160 Ton Down Moving Ram Press, 11″ Stroke, 21 x 20″ Platen.—Racine Pumps, Boosters, Valves, Logan Pumps, Valves.—250 Ton Farquhar Straightening Press, Bed 32″ Wide, 23′ Long. Self Contained.—200 H.P. 78 Gal. 3000# Pump. 200 H.P. 200 Gal. 1500# Pump, 18″ x 15′ Accumulator 1500#.—15″ x 11′ Acc. 400-2000#. 6″ x 9′ Accumulator-2000#. 300 Ton Press 20″ Ram 8″ Stroke 24″ x 20″ Platen. 300 Ton—1000 Ton Hobbing Press.—Hele Shaw Variable Pressure 33 GPM 2500#.—Vickers Oil Pumps 17 GPM 500 to 1000#. Elmes Horo. 4 Plunger 6½ Gals. 5000#.—Stillman 12 x 12″ Laboratory Presses. Hydro Pneumatic Accumulator, 42″ Air Cyl. 48″ Stroke. Reply Box 1225, Modern Plastics.

SKILLED ENGRAVER wishes position with progressive molding concern. Supervisory experience. Qualified to do all mold work. Master hobs. Knows how to handle duplicator, engraving machines and the making of masters for these machines. Expert Master Model Maker. Tentative ability. Reply Box C234, Modern Plastics.

EXECUTIVE ASSISTANT available: Young man 33, single, overseas veteran, B.A. degree, also architectural and mechanical drafting education. Recently connected with prominent midwest plastic molding concern. Experienced in most plant and office procedure, including handling personnel, customer correspondence, stock control, production schedules, operation injection molding machines, supervision shipping room. Excellent references. Reply Box C240, Modern Plastics.

FOR SALE: Hyd. Presses, 1 self contained fully aut. 5 ton Denn., 1— 36″ x 36″, 14″ ram, 200 ton, 1—26″ x 52″, 14″ ram, 385 tons; 3—12″ x 12″, 7½″ rams, 50 ton, 2—15″ x 15″, 8″ ram, 75 tons, 1—15″ x 15″, 10″ ram, 100 tons, 3—19″ x 24″, 10″ ram, 78 tons; 3—13″ x 19″, 12″ ram, 100 ton, 1—20″ x 20″, 13″ ram, 200 tons with pullbacks, 3—23″ x 17½″, 8″ ram, 75 tons with pullbacks, 1—16″ x 17″, 8″ ram, 75 tons, 1—22″ x 15″, 8″ rams, 75 ton, 7—12″ x 13″, 6½″ ram, 50 ton, 4—8″ x 9½″, 4½″ ram, 20 ton, 3—1000 ton 29″ ram presses, 3—2043 ton presses, 34″ ram, 1—24″ x 30″, 550 ton, 15″ ram, 1—20″ x 20″, 10″ ram, 100 ton; Pumps; 1—HPM triplex 1½ GPM 2500#, 1—Rob. Dup. 1½ GPM, 4000#, 1—Gould Trip. 12 GPM 1250#, 1—Worth 2½ GPM 4000#, 1—Worth. Trip. 12 GPM 2500#, 1—Elmes Dup. 1½ GPM 2850#; Preform Presses, Stokes Model T single punch. 1—DDS—2 Stokes, 1—Kux ICS Extr.; 1—Royle Perfected #3 cont. motor bedplate, 1—Housatonic 6″ worm, Mills, Calenders, Mixer Laboratory Presses, Accumulators, Hydropneumatic and weighted types, etc. HIGHEST PRICES PAID FOR YOUR USED EQUIPMENT. Universal Hydraulic Machinery Company, 285 Hudson Street, New York City 13.

PLANT WANTED
Plastic Compression Molding plant wanted. Location in the vicinity of New York preferred. Replies held strictly confidential. Reply C235, Modern Plastics.

MOLD, DIE & TOOL REPRESENTATIVE contacting die and tool shops in Detroit, Toledo & Cleveland area will have time for additional customer in 1947. Thorough knowledge engineering, designing, building and operating plastic molds, die-cast dies, etc. Can be of real assistance in an advisory capacity and expediting such items. References. Reply Box C231, Modern Plastics.

PLANT ENGINEER: Expanding Plastics and Rubber Molding concern established 60 years, vicinity Trenton, N. J., offers excellent future to the executive-type, college-trained engineer with 10 years' practical experience spent preferably in rubber and/or plastics. Position entails organizing and directing all plant service and maintenance facilities such as drafting, mechanical, electrical and power in a plant normally employing 600 persons. Please write fully, giving experience and salary expected. Reply Box C220, Modern Plastics.

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BUBBLE PIPE
MOLD FOR SALE
One 12 Cavity Bubble Pipe Mold adaptable for Leominster Tool or Reed Prentice Molding Machines. In new condition ready for immediate production. Write Box C237, Modern Plastics.

FOR SALE: 31—Stokes, Colton & Kux Rotary and Single Punch Preform Presses, ½″ to 4″. 8—Baker Perkins and Readco 100 Gal. Heavy Duty Double Arm Jacketed Mixers, practically new. 7—W. & P. & Readco Lab. to 100 gal. Mixers. 4—Mills and Calenders from 30″ to 60″.
BRILL EQUIPMENT COMPANY
225 West 34th St., New York 1, New York

INDIA
Great sales opportunity for an aggressive American manufacturer of Modern Plastics. This 100% Indian firm capable of getting complete distribution in South India. Write—S.S. Mohadevan, 250 Goods Shed Street, Madura, Madras, India.

MAKING THE MOLDS *that make for flawless molding*

A plastic part or product can be no better than the mold which mothers it. Each micrometric detail must first be skillfully machined into unyielding metal. The sleek, smooth finish of the molded part merely reflects the mirror-finish of the parent mold.

That is why **MPC** has set up this modern tool room . . . equipped with the most advanced machines, staffed by experienced craftsmen. Here at **MPC** the mold and the molded part are produced by the same organization. Here responsibility is undivided . . . another good reason for appointing **MPC** your molded plastics supplier. Submit your plastics product or problem to MOLDED PRODUCTS CORPORATION, 4535 W. HARRISON St., Chicago 24, Ill.

GRINDING SECTION

MILLING SECTION

DUPLICATING MACHINE with "electrical brain"

This 15C Gorton Electrical Duplicating Machine cuts intricate steel or nonferrous dies by following a wood or plaster model . . . much faster, more economical and more versatile than ordinary milling. It will take any size cavity up to 32" x 42".

DIE-MAKING CAPACITY AVAILABLE

We do not utilize the full capacity of this machine for our own purposes. We therefore solicit your assignments to mill dies for plastic or rubber molding, for die casting, forging etc. We will work from your model or plaster cast. Write for detailed information.

GENERAL VIEW OF TOOL ROOM

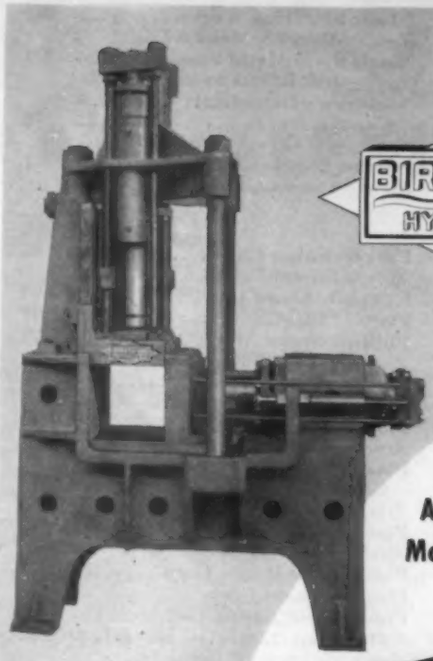
PLASTICS DIVISION

MOLDED MPC PRODUCTS

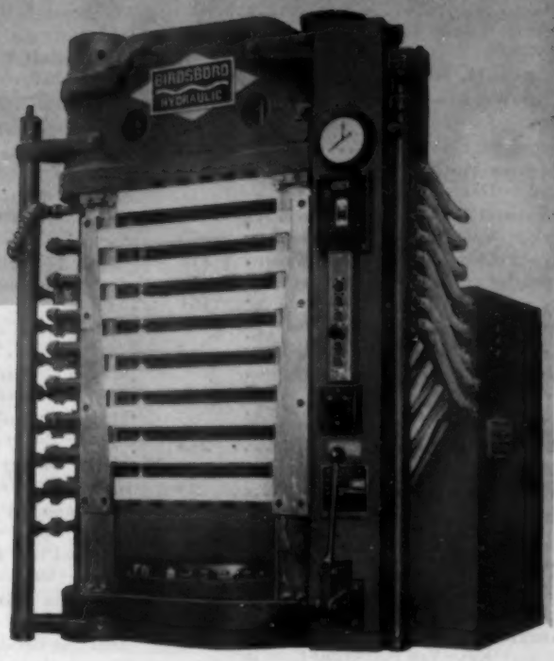
CORPORATION

MODERN PLASTICS ADVERTISERS

JANUARY 1947



BIRDSBORO HYDRAULIC



Laminating

Angle Molding

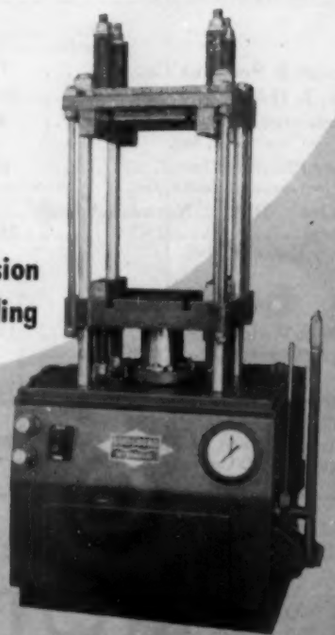
HYDRAULIC PLASTIC PRESSES

For Fast, Low Cost Production . . .

Presses for molding and laminating . . . Presses that are simple to operate yet unusually flexible and soundly engineered for speedy and economical operation that will give you the edge in the highly competitive days ahead. And their strong, rugged construction insures accurate die and platen alignment to meet rigid specifications for close tolerances. They are made in a wide range of sizes and capacities with manual or automatic controls for self-contained or accumulator operation.

Large Compression Molding

Compression Job Molding

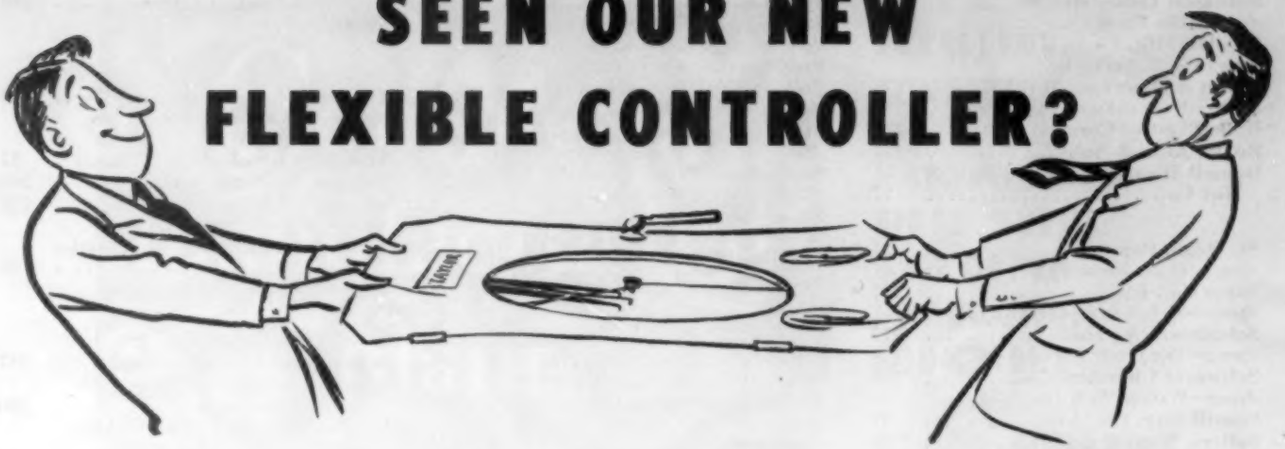


BUILDERS OF: Hydraulic Presses - Steel Mill Equipment - Rolls - Special Machinery - Crushing Machinery

BIRDSBORO

HYDRAULIC PLASTIC PRESSES

SEEN OUR NEW FLEXIBLE CONTROLLER?



YES, it's true. This Taylor Platen Press Control System is flexible enough for almost any kind of plastics molding job. It's particularly adaptable to short runs of products where the cure cycles vary.

The control temperature can be adjusted to suit the product. The duration of condensate discharge periods is adjustable. And the Taylor Flex-O-Timer (see drawing) is adjustable to the timing cycle as follows:

1. Total cycle is adjustable through the adjustable speed gear train—78 different drum speeds.

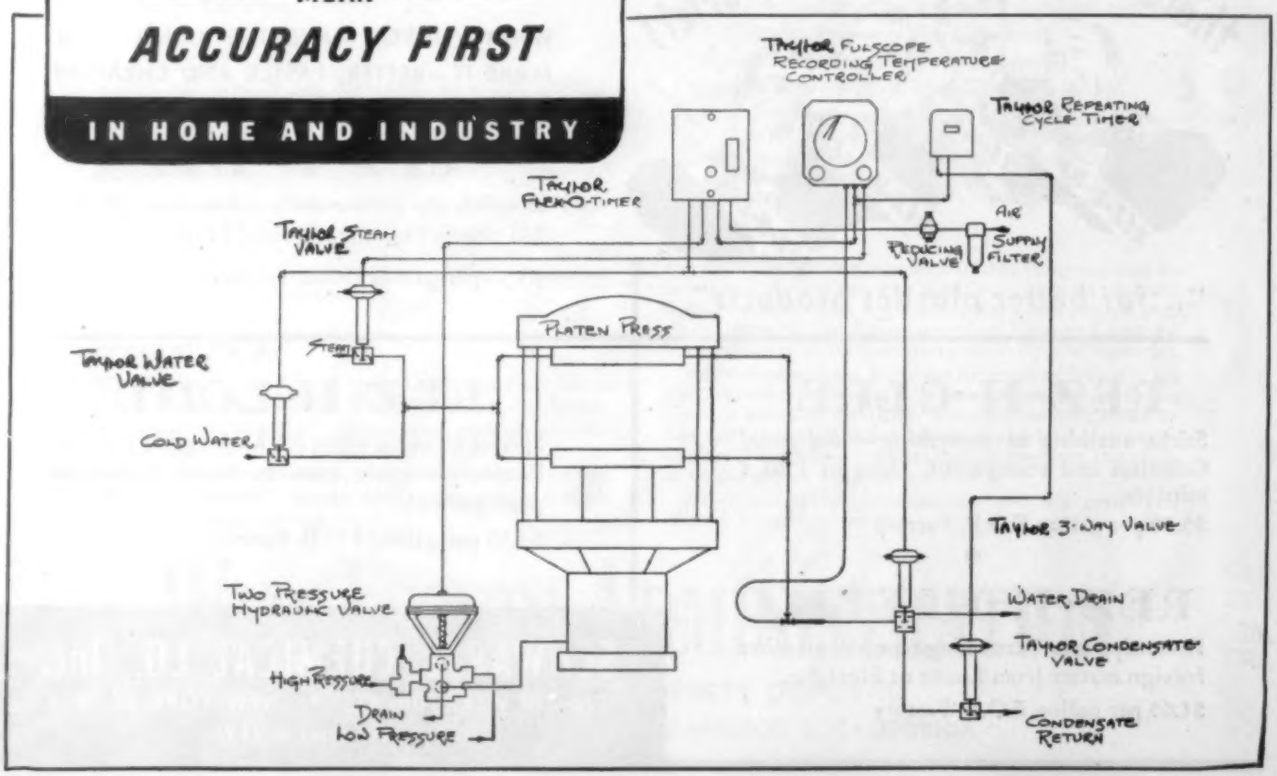
2. Actuating pins are fully adjustable so that lengths of each period in the sequence of operations can be varied.

3. Auxiliary timer permits cure period to be adjusted independent of other sequence periods.

4. Removable drums can be provided with actuating pins already set to permit a quick change for another mold setup.

Operation is completely automatic from the time you push the button until the press opens for the next load. Ask your Taylor Field Engineer or write Taylor Instrument Companies, Rochester, N.Y., or Toronto, Canada. *Instruments for indicating, recording, and controlling temperature, pressure, humidity, flow and liquid level.*

Taylor Instruments
MEAN
ACCURACY FIRST
IN HOME AND INDUSTRY



Complete manufacturing plant

HALF MILE SOUTHWEST OF PITTSBURG • CALIFORNIA

EXCELLENT CONDITION

★

NATURAL GAS-FIRED OVENS AND OTHER PRODUCTION EQUIPMENT

★

47,000 SQUARE FEET OF FLOOR SPACE

FOR SALE OR LEASE

This facility, NObs-172 Navy, built for the production of coating welding electrodes at a designed capacity of 4,000,000 lbs. of welding rods per month, was operated during the war by Arcrods, Inc. The plant could be readily utilized for production of welding rods, or converted for light manufacturing such as: molded plastics, ceramics, machine shop, etc.

GOVERNMENT OWNED SURPLUS PLANTS

LOCATION:

Approximately 4½ acres (lessee owned, government has option to purchase) fronting on the Martinez-Pittsburg County Road, about ½ mile southwest of Pittsburg, California.

TRANSPORTATION:

Spur track of the Southern Pacific R. R. serves plant. County road connects with arterial highways.

BUILDING:

One-story and mezzanine, 97′ x 385′, containing approximately 47,000 sq. ft. of floor space. Main production room, 97′ x 357′, with approximately 34,700 sq. ft. and ceiling height of 27′. Enclosed mezzanine contains about 9,700 sq. ft.

CONSTRUCTION:

Wood frame, wood sheathing; walls, concrete from grade to bottom of sash; wood studding, bridging, and sheathing to top of parapet wall; reinforced concrete footings supporting wooden columns at 16′ centers around wall; interior wooden columns on reinforced concrete footings; roof supported by timber trusses. Built-up roofing.

MACHINERY AND EQUIPMENT:

Many items of production equipment such as:

- 2 baking or drying ovens—each divided into 5 passes, approximately 135′ long with temperature ranging from 185° to 300° in 4th and 5th;
- 3 Simpson Intensive No. 2 Mixers;
- 4 double-feed welding rod hoppers;
- 10 wire straightening and cutting machines;
- 4 hydraulically operated, self-contained extrusion presses. Also tanks, cranes, pumps, shakers, sieves, conveyers, blowers, balers, filters, etc. Various items of machine tools, laboratory and testing equipment, office furniture and fixtures.

CREDIT TERMS:

Credit terms for the purchase of this property may be arranged. And if you can qualify as a small business firm, you may make application for a priority for purchase through the Reconstruction Finance Corporation, which priority is second only to Federal agencies.

Reference to these facilities by name of lessee is for identification only and has no connection with the lessee's plant or facilities. Information contained in this advertisement is not intended as a basis for negotiation. War Assets Administration reserves the right to reject any or all proposals.

All requests for information and all proposals should be addressed to:

WAR ASSETS ADMINISTRATION

OFFICE OF REAL PROPERTY DISPOSAL

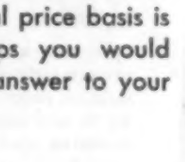
1182 MARKET STREET • SAN FRANCISCO 2, CALIFORNIA

894-T

Star Lite— Star Bright

Christmas trees, lighted with Raylite Star Lites and Tree Top Stars, now glow with new brilliance. The jewel-like rims of the Stars and the sunbursts surrounding the Star Lites, both Worcester moulded, are sparkling bright. Here again, our entire organization—engineering staff, designers and moulders — has focused its full attention on these Raylite parts. Thanks to our capacity, every requirement for volume production on an economical price basis is completely fulfilled. Perhaps you would like a Worcester Moulded answer to your particular problems.

A small, condensed, illustrated folder, which explains why you should go to a custom moulder, is yours for the asking.



Star-Lites and Tree-Top Stars courtesy Raylite Electric Co., New York, N. Y.

wmp

Custom Injection Moulding

WORCESTER MOULDED PLASTICS CO.

14 HYGEIA STREET, WORCESTER 8, MASS.

17 East 42nd St., New York 17, N. Y.

130 West Chippewa St., Buffalo 2, N. Y.

YOUR IDEA—your new product—your new project for development—may be waiting to be discovered here. Already this versatile plastic—BAKELITE polyethylene monofilament—has opened dozens of new fields of design.

It is so many-sided, so challenging in its properties, that an inventive mind cannot help speculating upon its possibilities. It is so light, for instance, that it floats on water. It can be strong enough to tow a glider—or a ship. It can be colorful enough to match a rainbow. It can be woven, knitted, braided, crocheted or power-loomed. In tape form it can be machined, drilled or welded . . . Does this start a line of thought?

Industrial designers particularly are urged to experiment with BAKELITE polyethylene as monofilament, tape, molded goods, or sheeting. This plastic possesses outstanding dielectric strength, it is moistureproof, resistant to acids, alkalis and greases . . . flexible . . . stainproof . . . with high impact strength at low temperature . . . and virtually insoluble in all solvents at normal temperatures.

Write Department BE-7 for complete technical data and engineering assistance.

TRADE—MARKS

BAKELITE

POLYETHYLENE

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

ROBERT C. VE

● DESIGNED AND ENGINEERED AT NO. 1 PLASTICS AVENUE

Plastics table tops can take it

● Don't worry, junior! You can't hurt that dinette table top. It is General Electric Textolite, a plastics material. Its lustrous surface resists scratching even better than low-carbon steel. It is impervious to food acids, alcohol, and disinfectants. And even a burning cigarette won't blister its smooth finish.

In stock colors and patterns or custom made, G-E Textolite serves not only in the home, but in hotels, restaurants, clubs, and similar establishments. It is just one example of the many ways that General Electric's *complete* plastics service is helping business attract sales and reduce costs.

In your own business, a plastics application—in your product or in your tools—may give you important manufacturing or selling advantages. It will pay to investigate. Talk it over with General Electric—the world's largest manufacturer of finished plastics products. Write to Plastics Divisions, Chemical Department, General Electric Co., 1 Plastics Avenue, Pittsfield, Mass. *An interesting illustrated booklet, "What Are Plastics?" is yours for the asking.*

G-E Complete Service—Everything in Plastics

BACKED BY 52 YEARS OF EXPERIENCE. We've been designing and manufacturing plastics products ever since 1894. G-E research works continually to develop new materials, new processes, new applications.

NO. 1 PLASTICS AVENUE—complete plastics service—engineering, design and mold-making. Our own industrial designers and engineers, working together, create plastics parts that are both scientifically sound and good-looking. Our own toolrooms are manned by skilled craftsmen—average precision mold experience, 12 years.

ALL TYPES OF PLASTICS. Facilities for compression, injection, transfer and cold molding . . . for both high and low pressure laminating . . . for fabricating. And G-E Quality Control—a byword in industry—means as many as 160 inspections and analyses for a single plastics part.

GENERAL ELECTRIC

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GENERAL ELECTRIC PLASTICS FACTORIES ARE LOCATED AT SCRANTON, PA. . . . MERIDEN, CONN. COSHOCTON, OHIO . . . FORT WAYNE, IND. . . . TAUNTON AND PITTSFIELD, MASS.

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